DOCUMENT RESUME

ED 283 709 SE 048 244

AUTHOR	Wiebe, Arthur, Ed.; Hillen, Judith A., Ed.
TITLE	AIMS Newsletter. Volume 1. Numbers 1-10, August-May, 1986-87.
INSTITUTION	AIMS Education Foundation, Fresno, CA.
PUB DATE	87
NOTE	338p.
AVAILABLE FROM	AIMS Education Foundation, P. O. Box 7766, Fresno, CA 93747 (Subscription $22.50 per year).
PUB TYPE	Collected Works - Serials (022)
JOURNAL CIT	AIMS Newsletter; v1 n1-10 Aug-May 1986-87
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Case Studies; Computer Software Reviews; *Elementary School Mathematics; *Elementary School Science; Elementary Secondary Education; Mathematics Education; *Mathematics Instruction; Newsletters; Problem Solving; Science Activities; Science Education; *Science Instruction; *Secondary School Mathematics; *Secondary School Science
IDENTIFIERS	*Project AIMS

ABSTRACT

Project AIMS (Activities that Integrate Mathematics and Science) produces a variety of curriculum materials that deal with the integration of learning experiences, problem solving activities, and the use of cooperative learning. This document is a compilation of the AIMS newsletters published during the 1986-87 academic year. Each of the ten issues contains: (1) three new, previously unpublished and reproducible activities (one each for the K-2, 3-5, and 6-9 grade level ranges); (2) two 8.5 x 11 inch blackline masters featuring one of the new science posters and one of the new problem solving mathematics posters; (3) a feature article about a school, school district, or state that is implementing the AIMS program in a systematic manner, describing the specifics of those efforts that may be helpful to others; (4) a feature article about one member of the AIMS National Leadership Network; (5) information about the release of new publications and new programs; (6) a special section devoted to Project SETUP (Software Evaluation and Teaching Utilities Program) software and book reviews; and (7) a reader's corner, which features teachers comments and suggestions for the use of particular investigations, as well as teacher-developed adaptations for special student groups. (TW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED283709

AIMS Newsletter

Volume 1. Numbers 1-10, August-May, 1986-87

"PERMISSION TO REPRODUCE THIS MATERIAL IN **MICROFICHE ONLY** HAS BEEN GRANTED BY

Arthur J. Wiebe

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

SE048244

BEST COPY AVAILABLE

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation

Volume I, Number 1 August, 1986 © AIMS Education Foundation

AIMS Education Foundation Initiates AIMS Newsletter

The AIMS Education Foundation is introducing its 10-issue-per-year **AIMS Newsletter** through this pilot issue. Regular issues will be published monthly, August through May.

The purpose of the **AIMS Newsletter** is to inform teachers and administrators about new developments in the wide-ranging AIMS programs.

Three new, previously unpublished activities will be presented in each issue, one at each of three levels: K-2, Grades 3-5, and Grades 6-9. In this way subscribers will receive a total of 30 new activities per year, nearly twice the number normally appearing in an AIMS book. All come with the standard AIMS duplicating rights for classroom use.

Also appearing in each issue will be two 8.5 × 11 inch blackline masters featuring one of the new science posters and one of the new problem-solving mathematics posters. The poster series are designed to "teach by temptation." That is, they are designed to stimulate student interest and curiosity and motivate students to undertake mathematics or science investigations on their own. They are also planned to involve parents with their children in simple-to-perform but significant investigations. Most of the science investigations can be done with materials found in the average home.

Each issue will feature a school, district, or state that is implementing AIMS in a systematic manner and will describe the particulars in each case as an aid for schools planning similar implementation programs.

The AIMS Education Foundation has initiated the AIMS National Leadership Training Program that will prepare participants to become members of the AIMS National Leadership Network. Members of the Network will be qualified to conduct in-service and staff development programs implementing Project AIMS and Project SETUP. Details of this program are described elsewhere in this issue. One member of the Network will be featured each month. The full list of Network members will be published periodically. Those workshops presented by members which are open to general enrollment will be announced in advance in the **Newsletter**.

AIMS is a dynamic program that is constantly developing new materials. Information about the release of new publications and new programs will be included in the **AIMS Newsletter**. The content of these new publications will be described in detail. Publications currently available together with ordering information are listed in this issue.

A special section will be devoted to Project SETUP book reviews. SETUP is the acronym for Software Evaluation and Teaching Utilities Program. Its purpose is to select the best commercial problem solving software and to develop materials for use before, during, and after on-computer time that will effectively integrate the software into the school program. The first four publications are announced in this issue.

A special reader's corner will feature teacher comments and suggestions for use of particular investigations as well as teacher-developed adaptations for special student groups.

The Fresno Pacific Math/Science Project summer programs in science, mathematics, and computer education will be announced and described. These programs annually draw participation

(cont'd on page 5)

AIMS...What's In the Name?

AIMS is the acronym for "Activities that Integrate Mathematics and Science." Begun in 1981 with a grant from the National Science Foundation, Project AIMS has expanded rapidly to encompass a broad range of activities that focus on the integration of learning experiences, problem solving activities, and the use of cooperative learning.

Project AIMS utilizes writing teams of classroom teachers writing at the grade levels they teach to develop these curricular materials. These teams work alongside the Fresno Pacific College faculty in mathematics and science education. Classroom testing of all materials is likewise done by other classroom teachers, again at the appropriate grade levels. Investigations are written for use in Kindergarten through middle school, including Grade 9.

The AIMS Education Foundation is a non-profit, tax exempt educational foundation incorporated in California. All net proceeds from the sale of materials are used to further the objectives of the Foundation. These include research, development, and publication of integrated, problem-solving curricular materials and all costs related thereto; partial and full scholarships to teachers who participate in writing projects; subsidy for the AIMS National Leadership Program; administration of the AIMS National Leadership Network and the AIMS Workshop Program; and similar activities.

While the initial thrust was to integrate mathematics and science, two subjects that should never have been separated as they are, the emphasis now is much broader. At this time there is a major effort to integrate mathematics, science, language arts, social studies, and cooperative learning to enhance the effectiveness of student learning experiences.

AIMS, therefore, is a continuing effort, rooted in the classroom, utilizing the vast wisdom and experience of classroom teachers. It can well be described as a grassroots movement that places much greater curricular design and decision making power into the hands of classroom teachers. You are invited to join hands in the efforts and spirit of AIMS!

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California **93747**. Volume I, No. 1.

EDITORS	Arthur Wiebe, Judith Hillen
STAFF ARTIST	Sheryl Mercier
OFFICE MANAGER	Sheryl Bishop
PROGRAM DIRECTORS:	
Fresno Pacific College Math/Science Project	Lawrence E. Ecklund
AIMS Education Foundation	Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes	Ted Ostrander
Project AIMS	Judith Hillen, Arthur Wiebe
Project SETUP	Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION

PRESIDENT	Arthur Wiebe, Ed.D.
VICE-PRESIDENT	Wilbert Reimer
SECRETARY	Lawrence Ecklund
TREASURER	Jon Hillen
ACCOUNTANT	Robert J. Dwyer
STAFF ARTIST	Sheryl Mercier

AIMS NATIONAL LEADERSHIP NETWORK

Listed are the members of the AIMS National Leadership Network. Members are qualified to conduct Project AIMS workshops, teach AIMS in-service courses for college credit, and serve as Project AIMS consultants.

MAUREEN ALLEN	Irvine, California
DONNA BATTCHER	Sparks, Nevada
JOE BLANC	Turlock, California
JOHN CAMPOPIANO	Modesto, California
HELEN CROSSLEY	Rialto, California
PAT DAVIS	Bakersfield, California
SUE DIXON	Monterey, California
SHELDON ERICKSEN	Fresno, California
KAY FLETCHER	Huntington Beach, California
ROBERT & DOROTHY GLOYD	Auburn, California
MARY GREEN	Newberg, Oregon
JUDY HARRISON	Hanford, California
DONNA HENSON	Redding, California
MAY HOSHINO	Honolulu, Hawaii
KEN KITAJIMA	San Jose, California
MARY LIND	Monterey, California
CAROLYN LITTLE	Palm Desert, California
SHERYL MERCIER	Fresno, California
ART RING	Campbell, California
KIM SUTTON	McKinleyville, California
FRAN THREEWIT	Santa Rosa, California
ROY TAKAYAMA	Honolulu, Hawaii
ANN WIEBE	Reedley, California
DAVE YOUNGS	Zaire, Africa

ADVISORY COUNCIL

FRESNO PACIFIC MATH/SCIENCE PROJECT
and
AIMS EDUCATION FOUNDATION

DR. DEL ALBERTI	Superintendent, Auburn Union Elem.
JUDY ANDERSON	Curr. Specialist: Math, Riverside County
VIRGINIA BORIS	Principal, Kastner Intermed., Clovis USD
GERLENA CLARK	Math Consultant, Los Angeles County
KATHY DIRANA	Science Coordinator, Region 14 TEC Ctr.
LINDA DRITSAS	Secondary Math Coordinator, Fresno USD
ANN GYMER	Math/Science Consultant, Madera County
NORWOOD HAZARD	Curr. Specialist: Sci., Riverside Co.
SISTER CHRISTINE HEALY	Superintendent, Fresno Diocese
LARS HELGESON	Science Coordinator, San Diego County
PHYLLIS HUNT	Curriculum Consultant, Merced County
GARLAND JOHNSON	Pres., Calif. Science Teachers Assn.
KEN KITAJIMA	K-12 Science Coordinator, San Jose USD
DR. ARIE KORPORAAL	Sci. Consultant, Los Angeles Co.
MIKE McQUARY	Supervisor of Instruction, Tulare Co.
DR. PAM NOLI	Madera Unified School District
DR. ROGER ORAZE	Admin. for Standards/Eval., Clovis USD
WILBERT REIMER	Prof. of Math, Fresno Pacific College
ART RING	Curriculum Coordinator, Campbell USD
GAIL ROBINETTE	Elem. Math Coordinator, Fresno USD
ED RODEVICH	Coordinator: Math/Science, Orange Co.
HAROLD SILVANI	Elem. Science Coordinator, Fresno USD
FRAN SLOWICZEK	Sci. Resource Spec., Region 15 TEC Ctr.
DR. MARVIN SOHNS	Director, Region 10 TEC Center
TONY SPEARS	Math/Science Coordinator, Fresno County
DR. PAUL TOEWS	Prof. of History, Fresno Pacific College
TIM WILKINS	Principal, Fresno Christian Elementary
JIM WILSON	Math/Sci/Computer Ed. Coord., Tulare City

First in the Project SETUP Series

Rocky's Circuits

Rocky's Circuits is the first AIMS publication in the Project SETUP series. It provides teacher and student support materials for **Rocky's Boots**, the award-winning logic and problem solving program from The Learning Company.

Rocky's Circuits takes the learner through the hands-on construction of the "logic gates" used in **Rocky's Boots**, using low cost and readily available materials. It provides essential background information for the teacher and offers numerous extension ideas to follow up the learner's software experience.

The electric circuits that students build are powered by flashlight batteries and are clearly laid out to precisely duplicate the function of the logic gates in **Rocky's Boots**.

Listen as Jim Wilson, the author of **Rocky's Circuits**, describes his classroom experiences.

"There is just something inherently interesting in putting a battery, a couple of paper clips, a light-emitting diode, and two pieces of conducting ribbon together in your own way and getting the system to work—to light the LED! It's what I call a 100/100 activity: 100 percent student participation, 100 percent student success. Couple this with the fact that it's good hands-on science and you really have a winner!

"Now, what if we could take this 100/100 activity and use it as a springboard for even bigger and better things like building series and parallel electric circuits at very low cost that model the operation of the AND, OR, and NOT logic elements used in computers! Wait, there's more. After laying this hands-on conceptual foundation for students, what if we had an efficient, clean, cheap, and fun way to build simple machines—machines that solve logic problems—using AND, OR, and NOT gates; and then turn the machines on and watch them work!

"That's not all! By combining the hands-on construction of these gates; the concept development with the computer software; and the application of these concepts, we are able to bring to the fifth through twelfth grade classroom a course in logic that exceeds any curricular standards I have seen established for such an essential part of any mathematics program!

"If we could do all of this, you would probably say we had a valuable set of developed and ready to use curricular materials. Well, we do!"

Rocky's Circuits and **Rocky's Boots** may be ordered from AIMS Education Foundation. See page 27.

• THIS ISSUE • THIS ISSUE • IN SUMMARY • THIS ISSUE • THIS ISSUE •

New AIMS Science Poster

"Teaching by Temptation" provides powerful motivation. Why not cultivate the natural curiosity of your students by displaying the new Project AIMS science posters in your classroom? The investigations use readily available materials. Excellent for use in the classroom or for parents to team with their children for at home. **Story on Page 10, instructions and poster on Pages 12-13.**

New AIMS Mathematics Posters

Problem solving takes on new meaning with the problems posed on these posters. The series is authored by two former students of Dr. George Polya, Wilbert Reimer and Arthur Wiebe, and is suitable for use with students in grades 5-12. **Story on page 10, instructions and poster on Pages 10-11.**

New AIMS Investigations

As will be the case in each issue, three new Project AIMS investigations are presented, one at each of three levels: K-2, Grades 3-5, and Grades 6-9. TEDDY BEAR MATH, by Lawrence Ecklund, has students using non-standard mass units to determine the mass of a whole orange, the peeling, and the "eating part". SOME LIKE IT SALTY, by Sandra Crepps, invites students to investigate how much salt in water is required to make an egg float with emphasis on observing, measuring, describing, and graphing. SCREEN TEST, by Arthur Wiebe, asks students to investigate the question of "What does a million look like?" using low-cost readily available materials. Careful measurement, finding the area of a rectangle, averaging, and interpreting are emphasized. **Instructions and student pages on Pages 15-24.**

Lodi Unified Introduces AIMS Districtwide

This is the story of how the Lodi Unified School District introduced the AIMS in a carefully designed, systematic manner. It is the first in a series relating how schools, districts and states are using Project AIMS. The October issue will feature the statewide program in Hawaii. **Story on Pages 4-5.**

Enrollments in Fresno Pacific College Math/Science/Computer Courses Break All Records

Over 1100 teachers participated in the 1986 summer program offered in the areas of mathematics, science, and computer programming and application. **Story on Page 6.**

Fresno Pacific College Announces 1987 Summer Program

The Fresno Pacific Math/Science Project will add the AIMS National Leadership and the Integrated Learning Institutes in its 1987 summer program. **Story on Page 7.**

Your Students Can Be Problem Solvers!

The first in a series of articles on problem solving by Wilbert Reimer of the Fresno Pacific College mathematics faculty appears in this issue. He studied under the late George Polya at Stanford University and brings that experience to bear on this series. **Article on Pages 8-9.**

"Rocky's Circuits" Introduces Project SETUP Series

Jim Wilson of Tulare, a program director of Project SETUP, describes the first publication in the Project SETUP series entitled "Rocky's Circuits." This book contains hands-on investigations that will help students to understand the logic in "Rocky's Boots", the award-winning, problem-solving program published by The Learning Company. **Story on Page 3.**

Training Program for AIMS National Leadership Network Launched

The AIMS Education Foundation has launched a program to train 200 highly qualified AIMS workshop leaders to meet the widespread demand for AIMS workshops. More than 300 hours of instruction in science, mathematics, cooperative learning, and integrated approach to teaching will be provided in the two-year program. **Story and application forms on Pages 29-32.**

These third grade students in Rosemarie Smith's classroom at Davis School are intently weighing an apple to determine moisture loss.

AIMS Comes to Lodi Unified School District

Rosemarie Smith, Davis School

(Ed. Note: This is the first in a series of articles describing how schools, districts, and states are implementing Project AIMS through carefully planned programs. The Lodi Unified School District consists of 13 schools serving grades K-8. Rosemarie Smith is a teacher in Davis School in the district. Dave Mende is the Science Coordinator for the Lodi schools.)

Enthusiasm abounds in the Lodi Unified School District! The reason is found in teachers and children engrossed in a fun, process oriented Science/Math Program called Project AIMS. The Lodi Unified School District has selected this program for use as a supplemental hands-on curriculum source.

Judith Hillen, a program director of Project AIMS, spent two days presenting a workshop on the materials. Over sixty mentors, Science Task Force members, and volunteers were selected to attend the workshop. The teachers were divided into two groups: primary teachers in grades K-3 attended the workshop on one day; and intermediate/middle school teachers in grades 4-8 attended the second day. After receiving the training from Mrs. Hillen, these teachers helped implement the program by giving 30-60 minute presentations to other staff members at their school sites. They are continuing to act as resource people for Project AIMS by assisting other teachers as needed.

District Science Task Force members have arranged the AIMS materials into grade level activity notebooks and each teacher in the district has received an activity notebook appropriate to their grade level.

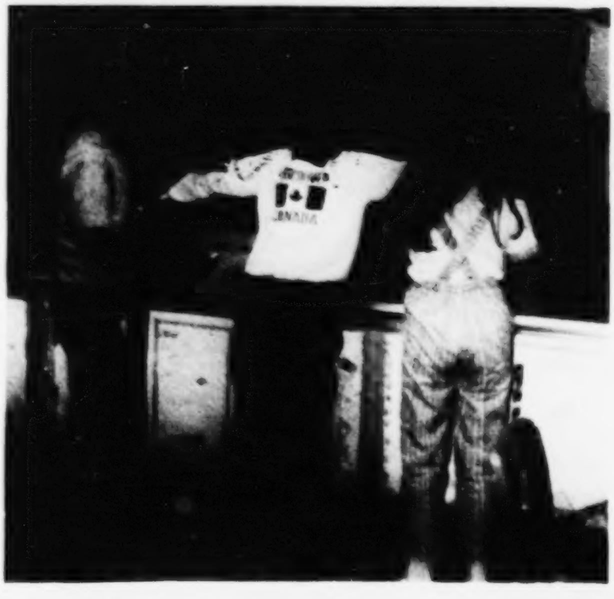
I have visited a number of schools in the district to see Project AIMS in action and to photograph some of the activities.

Tad Ishihara, a fourth grade teacher at Live Oak School, has video-taped a presentation on "How Many Teeth?", an AIMS lesson. This tape is made available to all teachers as a resource through the Curriculum Department.

Have you used "Quackers"? Joe Hammons, Vinewood School, developed the Quacker, straws of different lengths, to produce sounds. His third grade class hypothesized the pitch of the straws.

Oakwood School had fun with the "Are You Square?" AIMS lesson at a faculty meeting. They then moved through five stations where they experienced

Mrs. Napoleon's students are busily determining their shape.

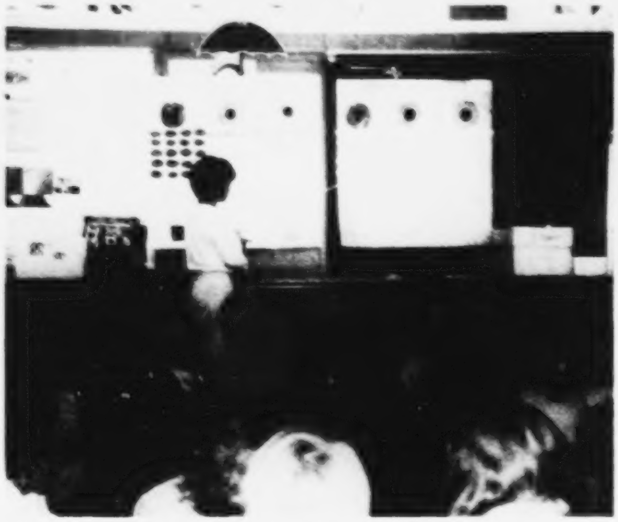


hands-on activities.

Additional exciting developments are in store for our teachers and students. "Partnership in Science" is a new program to be implemented by the Lodi Unified School District beginning in the 1986-87 school year. Dave Mende, Curriculum Coordinator, and the Science Task Force have developed a program that will entail the hiring of four Science Specialists who will circulate throughout the District. They will develop and present science lessons in elementary classrooms that utilize the basal text and Project AIMS.

(The Lodi Unfied School District is continuing to support the development of its faculty by sponsoring two teachers to participate in the AIMS National Leadership Training Program. The participant will then share the information from that program with teachers in the district on a systematic basis. In this way, the district is kept informed about the continuous flow of new materials being produced in Project AIMS. The district is also providing a subscription to **AIMS Newsletter** to each school to provide the teachers the latest materials.)

Winning the Propulsion Race



Was our hypothesis correct? Tarianne Cotton and Jean Robertson's kindergarten classes at Davis School are engrossed in the color of their eyes.

AIMS Program Directors Head Hawaii Writing Project

Judith Hillen and Arthur Wiebe, AIMS Program Directors, will be working with 30-40 selected Hawaiian teachers-writers August 18-22 to develop AIMS activities designed specifically for students in Hawaii.

The program is sponsored by the Hawaii Department of Education with funding support from the National Science Foundation and is under the direction of Miles Muraoka, State Educational Specialist in Science. Hillen and Wiebe will be joined by May Hoshino and Roy Takayama, Honolulu District Resource Teachers for Mathematics and Science, respectively.

Hawaii has launched a three-year state-wide program to train all teachers of grades 4-6 to use AIMS in their classrooms. Roy Takayama and May Hoshino conducted extensive AIMS workshops in Hawaii this year after completing their training at Fresno Pacific College.

"We have found AIMS to be excellent for promoting students' success by developing their enabling skills in mathematics and science," Mr. Muraoka states. "Our goal is to provide students with at least one activity each week using the philosophy and approach of AIMS. We believe AIMS provides fresh perspectives about students and their successes in school."

The Hawaii AIMS implementation program will be featured in the November issue of the **AIMS Newsletter.**

AIMS NEWSLETTER (continued from page 1)

from a national and international audience. During the summer of 1986 more than 1100 teachers enrolled in these summer courses which earn graduate credit.

Each issue will include one or more feature articles written by the Fresno Pacific Math/Science faculty dealing with topics of general interest such as the Model of Mathematics for understanding and evaluating learning experiences, a comprehensive strategy for problem solving, and the use of cooperative learning strategies with Project AIMS materials.

The annual subscription price is $20.00. Subscriptions will be offered only on an annual basis with ten issues from August to May constituting a year's subscription regardless of the time of the subscription. For example, if a subscription is received in December, all issues beginning with the previous August issue will be sent in the first mailing and the subscription will end with the following May issue. Since each issue will consist primarily of content that is of long-term value and the feature articles contain background information which is essential for the full implementation of AIMS and SETUP materials, such packaging is the most effective as well as the most efficient.

You are invited to be a charter subscriber. Just fill in the subscription form and mail it in today!

Stanley Bezuszka of Boston College brings excitement to secondary mathematics teachers.

Fresno Pacific College Summer Program Attracts Record Attendance

1100 Teachers Take Mathematics, Science and Computer Courses

The 1986 Fresno Pacific summer courses in mathematics, science, and computer education attracted more than 1100 teachers, up from 830 in 1985.

The fifteenth annual Festival of Mathematics enrolled 270 participants. Dr. Lola May returned as the general session speaker for K-6 teachers for the fourteenth year. Stanley Bezuszka, S.J., of Boston College was the general session speaker for teachers enrolled in grades 7-12 sections. Section instructors were Dr. Jonathan Knaupp of Arizona State University and Fresno Pacific College faculty Lawrence Ecklund, Dr. Arthur Wiebe, Judith Hillen, and Valerie Welk.

The six AIMS workshops had a capacity total enrollment of 440 compared to 265 in 1985. 50 others on the waiting list could not be accommodated. Most workshops were filled by the middle of April.

The first annual Science Festival was filled to its capacity of 250. Visiting scholars included Dr. Verne Rockcastle of Cornell University, Dr. Joe Abruscato of the University of Vermont, Dr. Del Alberti, Herb Strongin, Al Guenther, and Gilbert Yee. Fresno Pacific College faculty teaching in the Science Festival were Judith Hillen, Jim Greco, Jim Wilson, and Dr. Arthur Wiebe. Included among the registrants were seventy candidates in the AIMS National Leadership Training Program.

The computer education courses, under the direction of Ted Ostrander, attracted more than 200 participants.

That more and more school districts are sponsoring the attendance of their teachers was particulaly in evidence this summer. Approximately 400 of the participants received such support.

Hot air balloons provide applications for mathematics.

FRESNO PACIFIC ANNOUNCES 1987 SUMMER PROGRAM

Integrated Learning Institute Added

The 1987 Fresno Pacific College Summer Program will expand its offerings to include two new programs: the Integrated Learning Institute and the AIMS National Leadership Institute.

The Integrated Learning Institute will provide an in-depth exploration of a fully integrated approach to the teaching of all subjects in K-8. Dr. Yetta Goodman will be the general session speaker. Dr. Goodman is Professor of Education at the University of Arizona and co-director, with her husband Ken, of the Program in Language and Literacy. She is a long-time advocate of the Whole Language view of education which recognizes that language is best learned when it is studied in a natural context. From this perspective, integration is a key principle for language development and learning through language.

Additional visiting scholars with extensive experience in the integrated approach will join with members of the Fresno Pacific College faculty to provide leadership for this innovative program. Attendance will be limited to 250 participants. Teachers, curriculum leaders, and administrators interested in attending are advised to reserve places at an early date.

The AIMS National Leadership Institute is one phase of the training program for membership in the AIMS National Leadership Network described on pages 29-32. Attendance is restricted to candidates in that program and is limited to 200 participants.

The complete 1987 summer program with the number of units of graduate credit that may be earned for each course is as follows.

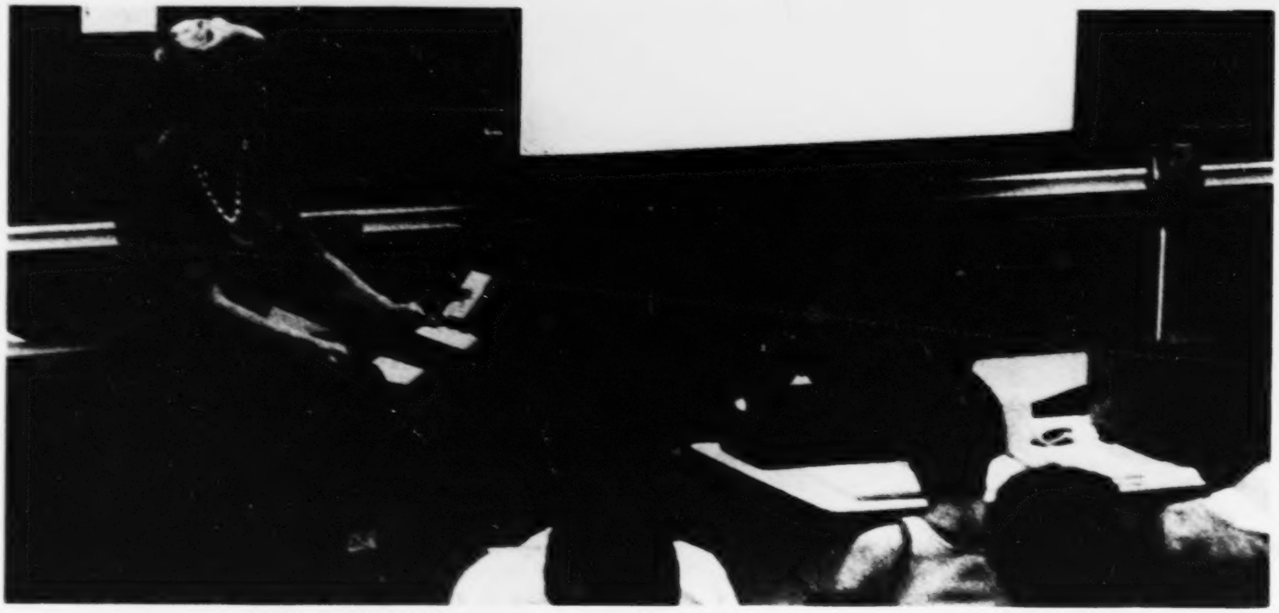
Intergrating math and science enriches the meaning of both.

AIMS Workshop I, May 11-15	2 units
AIMS Workshop II, June 15-19	2 units
Festival of Mathematics, June 22-July 3	4 units
AIMS Workshop III, July 6-10	2 units
AIMS Workshop IV, July 13-17	2 units
Computer Institute, July 6-17	4 units
AIMS National Leadership Institute, July 6-17	4 units
Science Festival, July 20-31	4 units
Integrated Learning Institute, August 3-7	2 units
AIMS Workshop V, August 3-7	2 units

Graduate credit is applicable to the Master of Arts in Education degree offered by Fresno Pacific College.

Further information about any of these programs may be obtained by writing to the Fresno Pacific Math/Science Project, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702 or calling (209) 453-2024.

Dr. Lola May will return for her 16th appearance as general session speaker in the 1987 Festival of Mathematics.



Your Students Can Be Problem Solvers!

Wilbert Reimer

(Ed. Note: Wilbert Reimer is a member of the mathematics faculty of Fresno Pacific College. He has studied extensively under the late Dr. George Polya—often referred to as the "father of the problem solving movement in America"—during his graduate studies at Stanford University. He regularly teaches undergraduate courses in problem solving. In this five-part series he will share enlightening and helpful insights and approaches to problem solving. As noted in the article, the new intermediate level AIMS Mathematics Poster Series incorporates the approaches described.)

Introduction

The intermediate level AIMS Mathematics Posters are designed to provide interesting and challenging experiences for students in the vital area of problem solving. While the problems themselves are varied, each one demonstrates the crucial process of the scientific method. Being able to form a generalization on the basis of specific findings is at the heart of the inductive process. Teaching that skill through mathematics is what these posters are all about!

Many of us already know that problem solving can be an exciting, exhilarating adventure. Students who have caught this enthusiasm may simply be given a problem and "turned loose" to see what they can find. Others, frustrated by lack of direction or insecure about process, will find these posters guiding them towards success. With just a little help, every student can make some significant discoveries about mathematics. Each experience will sharpen their mathematical skills **and** increase their problem solving confidence.

Central to the scientific method is the ability to recognize patterns. That is, we need to be able to generalize on the basis of specific data. Much of our daily living reflects this principle. Our local meteorologist knows that a thundershower is likely tonight because of certain cloud formations, barometric readings, and wind currents. He knows—thanks to many observers before him—that certain patterns usually lead to rain and thunder.

Patterns fill our world. Often we are unaware of them;, but opening our eyes to patterns increases our understanding and appreciation of the world around us.

Teaching students to recognize patterns in mathematics—and to **use** patterns to solve problems—is our objective in this poster series. These are skills which will serve the student well, not only in mathematics, but in many other disciplines.

Using the Wishful Thinking Method

One of the most powerful methods for discovering patterns leading to solutions is what the late George Polya, renowned author and teacher of problem solving, often referred to as the "Method of Wishful Thinking." He would say, "If you have a difficult problem, wish for an easier one!"

The method of wishful thinking starts by reducing a problem to a series of simpler problems, usually beginning with the easiest ones imaginable. When the solutions to these simpler cases are examined, a pattern often becomes apparent. The discovery of this pattern frequently makes the solution to the original problem surprisingly easy!

Many of the most significant mathematical patterns are found in Pascal's Triangle and in other number "families." Teachers and students alike will benefit from being familiar with these. (See Appendix)

Now, let's look at a sample problem, and apply the wishful thinking method.

Consider the problem of finding the sum of the first 100 counting numbers.

$$1 + 2 + 3 + 4 + 5 + 6 + \ldots + 100 = ?$$

This problem is somewhat difficult. Our first response might be "I wish I had an easier problem!" The Method of Wishful Thinking begins to operate!

The problem is difficult because there are too many numbers to add. Let's reduce this problem to the easiest one imaginable. That problem would ask us to sum the first counting number! That is, find the sum of 1. Now that's a lot easier! Next, let's find the sum of the first two counting numbers. That sum is 3. The sum of the first three counting numbers is 6. Continue adding and record the results in a table as shown below.

Number of Terms	Sum
1	1
2	3
3	6
4	10
5	15

Let's consider a second example. Find the sum of the first 50 odd numbers. That is, find the sum of the first 50 terms in the following series:

$$1 + 3 + 5 + 7 + 9 + \ldots$$

This problem is too difficult, because again there are too many numbers to add. We wish for an easier problem! The easiest problem is to sum only one term. Then we will sum two terms, three terms, etc. until we see the pattern that emerges. We collect our results in a table as shown below.

Number of Terms	Sum
1	1
2	4
3	9
4	16
5	25

Being able to reduce a problem to a number of simpler cases is the first stage in the wishful thinking problem solving approach.

Level I Solutions

The second stage deals with what we do with the data (usually collected in a table) we have obtained. Let's look down the second column of our table and see if there is a pattern in the numbers. If we can discover how to continue those numbers we will have discovered something important. We will call this discovery a Level I Solution.

Definition: A Level I Solution is discovering the vertical pattern in the second column of the table.

Look at the table we constructed for our first example. As we examine the numbers in the second column, namely 1, 3, 6, 10, and 15, we notice that they increase by 2, 3, 4, etc. The increases are consecutive. We have made a Level I Discovery! We can use this discovery to extend the numbers in the second column as far as we like!

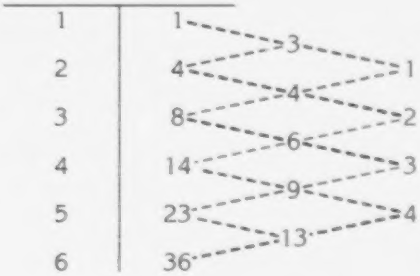
Looking at the second example we note that the numbers in the second column are 1, 4, 9, 16, and 25. We recognize these as perfect squares. We might also notice that the numbers in the second column increase by odds, namely 3, 5, 7, 9, etc. Either one of these discoveries is a Level I Solution and would allow us to extend the numbers in the second column as far as we like!

Some Hints for Discovering Level I Solutions

After students have reduced a problem to a number of simpler cases and collected their data in a table, it is a good idea to allow them to explore on their own, using trial and error, in an attempt to find the vertical pattern in the second column.

Finding the vertical pattern for the numbers in the second column can many times be facilitated by examining the differences of the second column numbers. If no pattern is seen in these differences, examine the difference of the differences, etc.

For example, suppose our chart contained the following numbers and we were looking for a Level I Solution.



Our first column of differences is 3, 4, 6, 9, 13, etc. Not seeing a pattern in these numbers we look at their differences. Here, of course, we see a pattern—the counting numbers! We are now able to continue the vertical pattern for the numbers in the second column indefinitely, by working backward from the counting numbers.

In applying the method of wishful thinking, some teachers might want to stop at this point with some students. If students are able to take a problem, reduce it to a number of simpler cases, and then discover a Level I Solution, they have latched on to a very powerful method of problem solving! For those who wish to go beyond this stage we now introduce another kind of solution. (To be continued)

Wilbert Reimer (center) shares the enthusiasm for problem solving with two of his students.

AIMS Workshop Instructors Available for California, Nevada, and Arizona Schools

The AIMS Education Foundation has trained workshop and in-service course instructors available for schools in most parts of California, Nevada, and Arizona. All of the instructors are classroom teachers with extensive training in AIMS investigations and the underlying philosphy, mathematical model, learning theory, and approach to teaching science.

Workshops may be scheduled for from one to three days. Full days rather than part days provide the most effective format and are strongly recommended. In-service courses for college credit may be scheduled for evening, Saturday, or late afternoon sessions. 15 hours of instruction are required per semester unit of credit. The per semester unit tuition rate is $65. The tuition fee includes one AIMS book or poster set (a $10.95 plus tax value). This combination provides an attractive and cost effective package.

The minimum enrollment required is 20 participants and the maximum is 35 participants. For scheduling an in-service course or a workshop in your area write to: Director of In-Service Education, AIMS Education Foundation, Box 7766, Fresno, CA 93747.

AIMS Mathematics Posters Encourage Problem Solving

The intermediate level AIMS Mathematics Problem Solving Posters provide students in grades 6-12 with a broad range of interesting problems to solve. Challenging and attractively displayed, the problems on these posters are sure to help students become more effective problem solvers. A "Problem a Week" is one of the recommended uses.

The series is authored by Wilbert Reimer and Arthur Wiebe, both of whom studied under the late Dr. George Polya at Stanford University. Part of his legacy is evident in this series.

Each set consists of five 15" × 20" posters printed on high quality stock; five parallel 8.5" × 11" blackline masters for duplication use; and full instructions and solutions to the problems.

The poster on page 11 is taken from Set F. Ordering information is on page 27.

The titles of the five posters in each set are listed together with the publication date.

SET A: PATTERN RECOGNITION SERIES: Predictable Patterns; In and Out; Start Around the Moon; Table Tally; Banquet at Tony's. Available September, 1986.

This set of posters exposes students to basic pattern recognition.

SET B: PICTORIAL NUMBER SERIES: Square Numbers; Triangle Numbers; Oblong Numbers; Pentagonal Numbers; Hexagonal Numbers. Available October, 1986.

Students discover some of the properties of these number "families."

SET C: PASCAL SERIES: Pascal's Triangle; Rowing with Pascal; Pascal Patterns; Pyramid Numbers; M-A-T-H-E-M-A-T-I-C-S. Available October, 1986.

Exposes students to Pascal's Triangle and its use in problem solving.

SET D: SERIES SUMS SET: Gauss' Challenge; 1 + 3 + 5 + 7; 2 + 4 + 6 + 8; 3 + 6 + 9 + 12; 4 + 8 + 12 + 16. Available November, 1986.

Asks students to sum series of numbers by using the inductive process.

SET E: THIS ONE NEEDS A TITLE: Twenty-one Connect (counts line segments within circles); Busy Intersections (counts intersections within circles); Diagonal Challenge (generalizes about diagonals within polygons); Block Blitz (traces pattern of blocks needed for a cubical structure); Tower of Cubes (counts blocks needed for pyramidal structures). Available November, 1986.

SET F: PATTERNS IN ADDITION AND MULTIPLICATION TABLES: Addition Table Challenge; Addition Table Staircase; Multiplication Table Challenge; Multiplication Table Staircase; Horizontal Squares. Students will learn to appreciate the many patterns existing in these tables. Available September, 1986.

Addition Table Challenge

Here is an excellent problem for discovering the power of the "helping column" strategy. In fact, the solution becomes apparent when we use the right two helping columns.

But first, the problem solver must secure the data by adding the numbers named in the body of each array and entering that information into the chart. The first few entries are shown on the blackline master which may be reproduced for classroom use.

The real challenge is to generalize the results. If a helping column is needed, what should it consist of? To answer this question, students will normally use trial and error. Someone will conclude that the helping column should consist of the produce of the dimensions of the array. The chart with its helping column would then look like this:

Size of Table	Helping Column	Sum
1 × 1	1	2
2 × 2	4	12
3 × 3	9	36
4 × 4	16	80
5 × 5	25	150

The focus now turns to the relationship between the last two columns. What can we do to the number in the helping column to get the number in the sum column? This leads us to construct a second helping column so that the product of the numbers in the two helping columns equal the sum. The chart now looks like this:

Size of Table	Helping Column 1	Helping Column 2	Sum
1 × 1	1	2	2
2 × 2	4	3	12
3 × 3	9	4	36
4 × 4	16	5	80
5 × 5	25	6	150
6 × 6	36	7	252
$n \times n$	n^2	$n + 1$	$n^2 (n + 1)$

The last row in the chart simply generalizes the results in each of the first three columns and then provides the basis for the generalization of the sum by multiplying the entries in the two helping columns. Eureka!

Dr. Arthur Wiebe and three Festival of Mathematics participants review the intensive mathematics involved in a Project AIMS activity.

Addition Table Challenge

Find the sum of the addition table entries by first examining a 1x1 table, next a 2x2 table, then a 3x3 table, etc. until a pattern emerges. Use the chart to record your results.

Addition Table

+	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

(1x1)

+	1
1	2

=2

(2x2)

+	1	2
1	2	3
2	3	4

=12

(3x3)

+	1	2	3
1	2	3	4
2	3	4	5
3	4	5	6

=36

(4x4)

+	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8

=

(5x5)

+	1	2	3	4	5
1	2	3	4	5	6
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10

=

Chart

Size of Table	Sum
1x1	2
2x2	12
3x3	36
4x4	
5x5	
6x6	
7x7	
8x8	
9x9	
20x20	
nxn	

Questions:

1. What is the relationship between the size of the table and the sum within the table?

2. Give the general result for nxn.

AIMS Education Foundation Accepting Workshop Invitations for 1987

The AIMS Education Foundation will accept up to twenty invitations to host AIMS Workshops during the summer of 1987. Schools or school districts in any of the fifty states my apply to host the AIMS Workshops. Priority will be given on the basis of the date of application.

Each workshop will be of five days duration and include 30 hours of instruction. The emphasis will be on the "hands-on" integrated mathematics/science activities drawn from the extensive AIMS resources, including materials to be developed in the 1986-7 writing programs.

Experienced workshop leaders drawn from the AIMS National Leadership Network will serve as the instructors.

Host schools must provide appropriate classroom space and related services at no cost to the Foundation. The Foundation will pay for all instructional costs, the hosting of instructors materials and supplies. The Foundation will also supply the needed equipment.

The minimum enrollment is 20 and the maximum 40 for each workshop section. Pre-registration will determine whether the minimum enrollment is assured and will be used to limit each workshop section to the maximum. Schools and school districts may join efforts to assure the minimum enrollment. The Foundation will provide promotional literature upon request.

Each sponsoring school may choose from several formats: a single section workshop in which the entire range of K–9 materials is presented and explored; a two-section workshop in which instruction is focused on a K–3 strand and a grades 4–8 strand (minimum total enrollment is 40 participants); or a three-section workshop in which K–2, Grades 3–5, and Grades 6–9 strands are offered (minimum total enrollment is 60 participants). An instructor is provided for each strand.

Participants will receive 30 hours of instruction, numerous handouts of AIMS materials with duplicating rights, and their choice of three Project AIMS publications. The basic cost without credit is $160. Two semester units of college credit is available for an additional $40 fee. College credit is optional.

Schools desiring to host AIMS workshops are encouraged to contact the AIMS Foundation promptly. Full details will be provided together with the formal application form. Address all correspondence to:

1987 AIMS Workshops
AIMS Education Foundation
Box 7766
Fresno, CA 93747

AIMS Science Posters "Teach By Temptation"

The AIMS Science Posters Series will provide teachers with a rich resource for stimulating student interest in undertaking simple scientific investigations. These attractive posters are designed to evoke the curiosity of students and motivate them to investigate a broad range of questions. The science investigations presented in this series are such that students can do most of them at home together with their parents. All are sure to arouse interest in science as your students "do the work of the scientist" exploring the unknown. These activities are suitable for use in grades 2-9.

Each set consists of five 15" x 20" posters printed on high quality stock; five parallel 8.5" x 11" blackline masters with the same materials as the posters for duplication use; full instructions for the investigations; and full explanations of the science phenomena. This format makes it possible to use the large posters to create curiosity and the blackline masters for individual, small group, or total class instruction, recording and discussion.

The Science Series is authored by Harold Silvani, Elementary Science Coordinator, Fresno, California Unified School District. The art work is by Sheryl Mercier.

The poster on page 13 is taken from Set B.

The titles of the five posters in each set are listed. Sets A, B, C, and D are already available. The remaining sets will be available on the dates shown. Ordering information is on page 27.

SCIENCE POSTER SERIES

SET A: Punctured Plastic Bottle; Balancing Forks; The Egg in Water; S.S. Paper Clip; Floating and Sinking.

SET B: Burning Walnut; Poor Man's Flashlight; Butter and Margarine Candles; Covered Candle; Pepper in the Pie Plate.

SET C: Ice Cube in Water; Melting Ice Cube; Colored Ice Cube in Hot Water; Ice Water in Tin Cup; Hot and Cold Water.

SET D: Water in 5 Containers; Food Coloring in Oil and Water; Orange in Water; How a Plant Carries Water; Weighing Objects in Water.

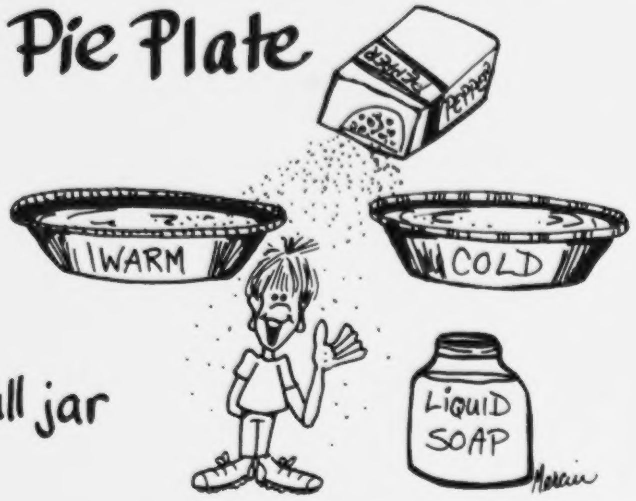
SET E: Homemade Fire Extinguisher; Inverted Tumbler in Aquarium; Card On a Spool; Balancing Clown; Magnet in Sand and Dirt. (Available September, 1986)

SET F: Water Drops On a Penny; Collapsing Can; Conductors of Electricity; Magnetizing a Nail; Penny On a Card. (Available October, 1986)

SET G: Paper Clip Switch; Pouring Carbon Dioxide; Inverted Tumbler; What Will a Magnet Attract?; Hot Salt Water. (Available November, 1986)

SET H: Floating Candles; Switches in Pairs; Floating Paper Clip; Finding the Center of Gravity; Breaking Down a Sugar Molecule. (Available December, 1986)

Pepper in the Pie Plate



• Materials:

2 Pie plates
Warm water
Cold water
Pepper
Liquid soap in a small jar

• Procedure:

1. Fill one of the pie plates with warm water, the other with cold water.
2. Sprinkle some pepper on to the water in each of the pie plates and observe the results.
3. Touch the tip of your finger to the liquid soap in the small jar.
4. Slowly immerse your finger into pie plate filled with warm water. (Immerse it at the edge of the pie plate.)
5. Repeat Steps 3 and 4 using the pie plate with cold water.

• Questions:

1. What happened to the pepper in the warm water when the soapy fingertip was placed near the edge of the pie plate?
2. How did the results using cold water compare with the results using the warm water?
3. How does soap assist in cleaning dishes, clothes or a person's body?
4. What variables could be added to this experiment?

AHA!

5. What is your explanation for what happened?

PEPPER IN THE PIE PLATE

GENERAL INFORMATION

Most of the black pepper that is used to season food comes from the East Indies and South America. The plant, which is often more than 15 feet tall, produces berries twice a year. The berries are harvested and then dried. After drying, the product is ready for market.

Water is one of the few substances which occur commonly in three different forms—liquid, solid, and gas. When poured into a glass container, such as an empty mayonnaise jar, it climbs slightly higher on each side than in the middle. Water molecules adhere (cling) better to glass than to other water molecules. This makes the water molecules climb the sides of the jar. The attraction between "unlike" molecules is called *adhesion*.

Water molecules are also attracted to each other. The attraction of one water to another is called *cohesion*. The result of the attraction, or cohesion, is called *surface tension*. Surface tension causes water to have a "skin" that will support weight. If you carefully lower a needle onto the surface of the water, it will float—the weight is being supported by the "skin," or cohesion, of the water molecules. If the needle is dropped onto the surface, it will break the surface tension and sink to the bottom.

Liquid soap can be used to break the surface tension of water. Soap is used in the cleaning process because it surrounds dirt particles and speeds up the wetting process, thereby making the washing process easier than without soap.

MATERIALS

Use two aluminum pie plates, paper plates or regular dinner plates. White or red pepper can be used; however, black pepper is recommended so the results can be seen more dramatically. Bar soap can be used instead of liquid detergent.

PROCEDURE

Follow the procedures 1 through 5. Fill the plates so the water level is about ½" from the top. After the pepper is sprinkled on the water (procedure #2), immerse your finger into each of the plates, then follow procedure #3 by repeating procedure #2 with the soap on the tip of your finger.

POSSIBLE ANSWERS

1. When the finger with soap on it was placed in the water near the edge of the pie plate, the pepper "scattered" to the other side.
2. The pepper in the cold water did not "scatter" as dramatically as the pepper in the warm water because the cold water molecules have a stronger bond than the warm water molecules.
3. The purpose of soap in laundering or washing dishes is to emulsify or to surround dirt particles with a film. Detergents make washing easier by speeding up the wetting process.
4. Some of the variables that could be added include the following: (1) compare the results using distilled water with regular tap water, (2) use powdered laundry soap or a bar of soap instead of liquid detergent, (3) sprinkle the pepper on white vinegar or oil and repeat the procedure, and (4) repeat experiment using milk as the liquid.
5. When soap is added to water (then touched by a soapy finger tip) the water's surface tension is broken and the molecules move away from each other.

APPLICATION

Discuss why soap is added to dishwater or a washing machine. Have students suggest why dirt is removed easier when warm or hot water is used with soap. (The soap mixes easier with warm water because the molecules are moving faster than they are in cold water.)

Have students bring different brands of soap and test each to find out which one removes dirt easiest.

To demonstrate how soap speeds up the wetting process, fill two glass tumblers with water. Cut several short pieces of grocery string (1" to 2" lengths) and drop an equal number into each tumbler. To one of the tumblers add a teaspoon of liquid detergent and observe. (The string in the tumbler with the soap becomes water-soaked and sinks almost at once. The string in the tumbler without the soap will float on the surface and take a longer time to become water-soaked.)

TEDDY BEARS AND ORANGES

I. Topic Area:
Finding the mass of oranges in non-standard units

II. Introductory Statement:
Students will use a non-standard unit of measure, Teddy Bears, to count, weigh, and compare.

III. Math Skills

Counting
Massing (weighing)
Comparing
Estimating
Adding and subtracting
Writing equations

Science Processes

Observing
Recording data
Classifying
Communicating
Predicting

IV. Materials:

Oranges, one for each group
Primer Balances
Teddy Bear Counters

V. Key Question:
How many Teddy Bears does your orange weigh?

VI. Background Information
To build a strong foundation in the concept of measurement, children need many experiences with non-standard units of measurement. By using Teddy Bear counters, the activity becomes a simple counting experience. Teddy Bear counters (available in most educational supply stores) come in four colors: red, yellow, blue and green and lend themselves well for many counting, measuring, comparing and patterning activities.

VII. Management Suggestions

1. Oranges tend to be messy but one can limit the mess by scoring the orange rind into crescent shaped sections to facilitate peeling.
2. One may wish to substitute tangerines for oranges. They weigh less and they are easier to peel.
3. If the oranges are too heavy, the number of Teddy Bears necessary to weigh them may be inappropriate for the number readiness of the students. Pick small oranges.

VIII. Procedure

1. Guess how many Teddy Bears your orange weighs. Record.
2. Put your orange in the balance. Put in enough Teddy Bears to balance the orange. Remember to make the scale boxes even. Record the number of red, yellow, green and blue Teddy Bears. Then find how many there are all together.
3. Compare your guess to the actual number of Teddy Bears the orange weighed.
4. Peel the orange. Guess how many Teddy Bears the peeling weighs. Record.
5. Weigh the peeling. Record how many Teddy Bears of each color were used and the total.
6. Guess how many the eating part weighs. Weigh, count, and record.
7. Now, from the beginning, you tell the story. "First, I guessed . . . etc."

IX. Discussion

1. Let's write a number story about your orange. Let the letter "O" stand for the whole orange. Let "P" stand for the peeling and "E" for the eating part. The whole orange, O, is equal to the sum of the parts, P and E, or $O = P + E$. Substitute appropriate numbers in the equation. In some cases, the parts many weigh more than the whole because the Teddy Bears are not a critical enough measuring tool and students are measuring to the nearest Teddy Bear. Furthermore, measurement is always approximate, not exact. Some students may recognize the problem and tell you that the peeling for instance weighs 14½ Teddy Bears when they know halves.
2. Now, write a subtraction number story. If I have the whole orange, O, and I eat the eating part, E, how much do I have left? $O - E = P$.
3. Let students use the Teddy Bears to retell the story and show that the whole is equal to the sum of its parts or that when you remove or take away one of the parts the other part is left over.

XI. Extensions
Try other fruits. Build the concepts of whole = part + part and whole − part = part.

Five Project AIMS writers refine a new investigation in preparation for field-testing.

TEDDY BEAR MATH

Page 1

Name: ______________________

Teddy Bears come in four colors....red, green, yellow, and blue. We will use Teddy Bears to count, to weigh, to compare, to add, and to subtract.

1. Guess how many Teddy Bears your orange weighs:

My orange will weigh ________ Teddy Bears.

2. Put your orange in the scale box. Now put in enough Teddy Bears to balance your orange......remember to make scale boxes even.

How many Teddy Bears are there?

Reds ________
Greens ________
Yellows ________
Blues ________

All together ________

My orange weighs ______ Teddy Bears. There are ______ red Teddy Bears, ________ green Teddy Bears, ________ yellow Teddy Bears, and _______ blue Teddy Bears.

I guessed that my orange would weigh ______ Teddy Bears.
My orange weighed _______ Teddy Bears.
The difference between my guess and the weight of my orange was ________ Teddy Bears.

My guess was too high ________
My guess was too low ________

TEDDY BEAR MATH

Page 2

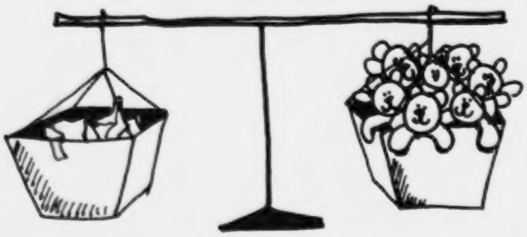
Name: ____________________

3. Please peel your orange. Guess how many Teddy Bears your peeling will weigh.

My orange peeling will weigh ______ Teddy Bears.

4. Please weigh the peeling with the Teddy Bears.

How many Teddy Bears are there?
Reds ______
Greens ______
Yellows ______
Blues ______



All together ______

5. Now, can you answer the big question? If you eat the orange without the peeling, how much will the orange weigh in Teddy Bears? __________

The whole orange weighed ______ Teddy Bears.

The peeling weighed ______ Teddy Bears.

The eating part weighed ______ Teddy Bears.

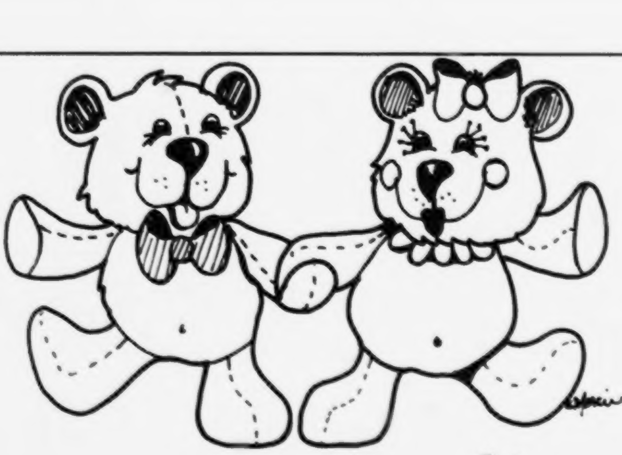
TEDDY BEAR MATH

Page 3

Name: ____________________

Now you tell the story:

I guessed that the whole orange would weigh ________



SOME LIKE IT SALTY

I. Topic Area:
Oceanography

II. Introductory Statement:
Students will observe that a fresh egg sinks in a glass of water, but will float when enough salt is added.

III. Math Skills	**Science Processes**
Measuring	Observing
Recording data	Recording data
Graphing	Controlling variables
Averaging	Interpreting data
	Hypothesizing

IV. Materials:
Water
12 fresh eggs, 1 per group of 3 students
Salt
12 teaspoons, 1 per group
1 graduated cylinder or measuring cup per group
Activity worksheets. 1 per person

V. Key Question:
What will make a fresh egg float in water?

VI. Background Information
By increasing the amount of salt in the water, you make it more dense than the egg, **causing** the egg to float. Students might have noticed that it is easier to float in ocean water than in fresh water or they might be familiar with the fact that scuba divers wear weight belts in ocean water so that they will not float to the surface.

VII. Management
This activity can be done individually or in small groups of 3, for example. Students can take turns adding salt and recording.

VIII. Procedure

1. Have students observe a glass of water and an egg. Ask students what will happen if you put the egg into the water. Predict whether it will float or sink. Put the egg into the water. If the egg is fresh, it will float.
2. Ask students what might happen if salt is added to the water. Divide the class into teams of scientists to measure and observe what effect the salt in the water will have on the egg.
3. Pour a measured amount of water into the container, 175 ml is recommended. Put the egg into the container of water.
4. Begin to add level teaspoons of salt, a teaspoon at a time into the water, stirring well after each spoonful until the salt is dissolved.
5. After each teaspoon observe and record any changes on the student worksheet.
6. Continue to add salt until the egg breaks the surface and floats.
7. Record on the graph how many teaspoons it took before the egg floated.
8. Add up each team's total and divide the total by the number of teams to find a class average.

IX. Discussion

1. What happened after the first few teaspoons? Teaspoons 4 and 5? Teaspoons 6 and 7? 8 and 9?
2. Did everyone have the same results? Why or why not?
3. How can these results help us to understand why a diver wears weight belts in salt water?

X. Extensions

1. Will more salt make the egg float even higher?
2. Will salt in a different liquid be different? (cooking oil, vinegar, carbonated water)
3. Are there any other substances that may be added to water that will cause the objects to float? (Try baking soda, sugar, etc.)

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ______________________________

Address: ______________________________
Street City
____
State Zip Code

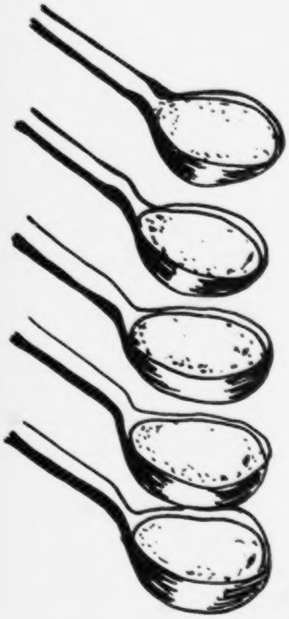
Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747

Some Like it Salty

Name: ______________________

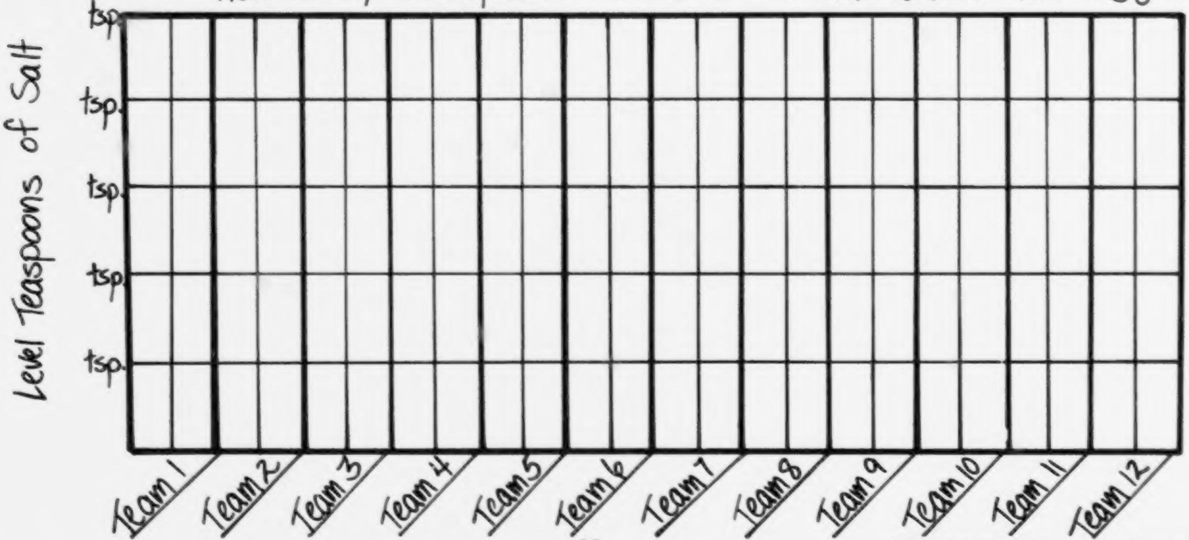
______________________ Group's Name

Pour 175 ml of water into a cup or glass. Gently place the egg into the container. Measure one level teaspoon of salt. Stir the salt into the water completely. Record your observations. Keep adding level teaspoons of salt until the egg floats. Make a graph to show how many level teaspoons of salt each team used.



Describe what you see after adding each teaspoon.

How many teaspoons of salt did it take to float the egg?



Group Data Sheet

Some Like it Salty

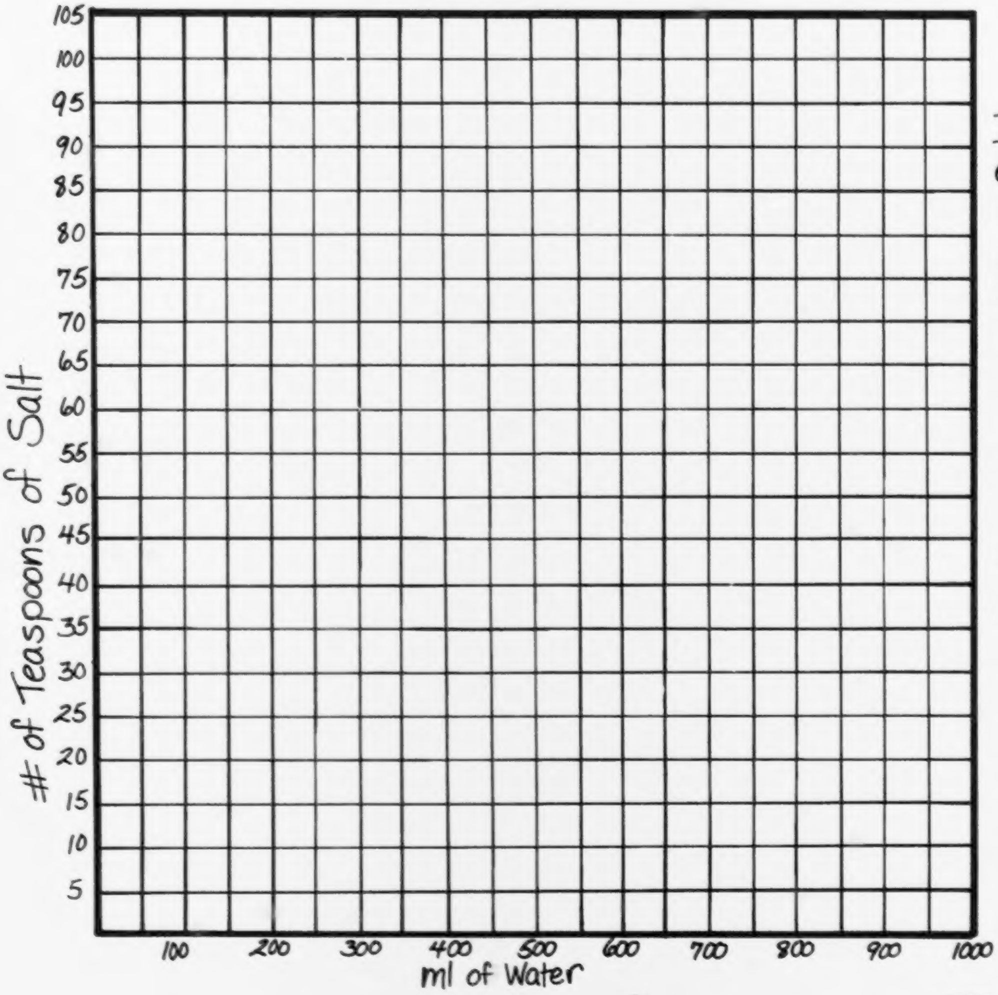
Name: ____________________

Group's Name: ____________________

Our Results: ________ ml water

________ #tsp. salt

Group Name	ml of Water	#of teaspoons Salt
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		



In this experiment, each group will use a different amount of water to float their egg in. Gather and record data from at least 10 samples. Graph the results.

What is your conclusion? ________

____

____

____

____

____

____

SCREEN TEST

I. Topic Area:
Searching for a representation of a million.

II. Introductory Statement:
Students will find how large a fiberglass insect screen needs to be in order to have approximately one million openings.

III. Math Skills
- Estimating
- Measuring to the nearest millimeter
- Computing areas
- Converting millimeters to centimeters
- Converting square centimeters to square meters
- Finding averages
- Using information from a table

Science Processes
- Observing
- Estimating
- Recording data
- Interpreting data
- Generalizing results

IV. Materials:
- 3 pieces of insect screen for each group
- Metric rulers marked in millimeters
- Screen Test worksheets
- Meter sticks

V. Key Question:
How much is a million? Can we see a million of something?

VI. Background Information
How many of us have an idea of what a million of something looks like? In this investigation, students will have extensive experience in finding areas as they search for a million openings in the insect screen. Thorough instruction in finding areas should precede the investigation. As they convert from square centimeters to square meters it is important to know that there are 100 × 100 = 10,000 square centimeters in a square meter. It takes about 2.4 square meters of insect screen to have a million openings or holes.

VII. Procedure
The fiberglass insect screen is available at little cost from buidling supply stores. A roll that measures over 12 square feet costs about $3.00. Only about one square foot is needed to supply the required number of pieces. The screen is easy to cut with a scissor and leaves no sharp protruding ends as would metal screen. When cutting the screen, follow vertical and horizontal threads with care. Most screens have holes that are not square. Therefore, to obtain fairly uniform results, the sample screens should be cut to be approximately, but not precisely, square - approximately 3 to 5 centimeters square. Each group should receive three pieces of differing dimensions.

Introductory Activities:
1. Project the image of a section of screen about 3 × 5 cm on the screen using an overhead projector. Leave the image on for about five seconds.
2. Announce that you want each team to determine their best strategy for estimating the number of openings. Tell them that you will project the screen for about thirty seconds during which time they can execute their strategy. Give the teams several minutes to determine their strategy before flashing the image on the screen.
3. Record the estimates of each team. Then have someone check the number of openings and report it to the class. Let each team compute their per cent of error by dividing the amount of difference between their estimate and the count by the actual count.

Next have students follow the steps as outlined on the worksheets. The following hints might be helpful.

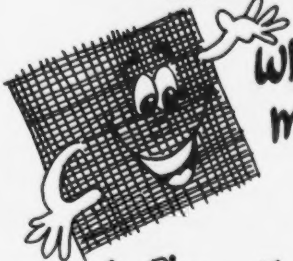
a. By placing the screen into a corner, the work is simplified.
b. Millimeters are changed to centimeters by moving the decimal one place to the left.
c. The easy way to find the number of openings is to multiply the number in each row by the number of columns.
d. To find the number of openings per square centimeter divide the number of openings by the number of square centimeters.
e. To find the number of square meters of screen needed divide the number of square centimeters of screen by 10,000.
f. To find the average length per opening divide the number of openings in a row by the length of the row measured in centimeters. Similarly, find the average width per opening.

IX. Discussion
1. Why did the results differ?
2. What effect would it have on the count of openings per square centimeters if the shape of the screen would have been 8 cm long and 2 cm wide? (The difference allowed for each opening per unit of length and width is different so it would give different results depending on how the piece was cut from the original screen.)

X. Extension
Students might suggest other ways of finding a million. For example, if the school yard is surrounded by a link fence, they could find how many openings there are between posts and from that determine how many "post" lengths would have one million holes. Such a daily presence as that of the fence would be remembered a long time after such a calculation. This extension also finds application for the area formula.

________________________________ Name

SCREEN TEST



What does a million look like?

1. Place 3 samples from a roll of screen into the spaces on this page. Carefully mark the location of each of the corners.
2. Remove the screens and connect consecutive corners of each screen with line segments to form rectangles.
3. Measure the length and width of each screen to the nearest millimeter but record the measurement in centimeters correct to the nearest tenth. (68mm = 6.8 cm)
4. Make the required computations to complete the chart on the following page.

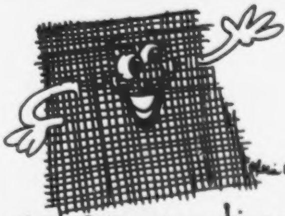
I look like a million today!

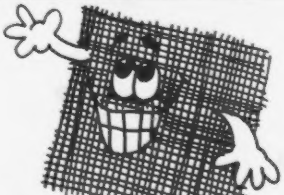
Name

SCREEN TEST page 2

Average Number of Openings per Square Centimeter

Sample	Measurements in cm		Area in cm^2	# of Openings per		Total # of Openings	Number of Openings per cm^2
	Length	Width		Row	Column		
						Total	
						Average	





1. How many square centimeters of screen would it take to contain a million openings?

2. How many square meters of screen would it take to contain a million openings?

Use one sample only for the following:

3. What is the average length *per* opening in the screen?

4. What is the average width *per* opening in the screen?

First Project SETUP Publications Available

Project SETUP (the acronym for Software Evaluation and Teaching Utilities) has as its purpose the selection of outstanding, problem-solving, interactive software programs and the development of appropriate classroom-ready materials to fully integrate the software program content into the curriculum. Therefore, SETUP is devoted to developing materials that support the classroom use of problem-solving software.

Each SETUP book contains highly motivational student and teacher materials designed to enhance the problem solving experiences derived from the use of the selected software.

Each book presents a wide range of activities that students use before, during, and after their time at the computer. These activities—many of which are hands-on projects—clarify and extend the concepts contained in the software.

Each book correlates its activities to the major curriculum areas of science, mathematics, social studies, and language arts. Where appropriate, curriculum integration is built into each book. Materials of a drill and practice nature have been kept to a minimum and are used only when necessary.

A major need exists for excellent computer software to be integrated into the standard curriculum. Often the roadblock is the lack of appropriate supplementary materials. Imaginative materials are needed to bridge the gap. Project SETUP addresses that need through the development of these supplementary materials. Written and classroom tested by classroom teachers, **SETUP books provide that critical next step for the most effective use of software programs as an integral part of the curriculum.**

ROCKY'S CIRCUITS

Rocky's Circuits provides teacher and student support materials for **Rocky's Boots**, the award-winning logic problem-solving program from The Learning Company. **Rocky's Circuits** takes the learner through the hands-on construction of the "logic gates" used in **Rocky's Boots**, using low cost and readily available materials; provides essential background information to the teachers, and offers numerous extension ideas to follow-up the learner's software experience. The electric circuits, powered by flashlight batteries, are clearly laid out and precisely duplicate the function of the logic gates. Grades 5-12.

THE GOLDEN AGE OF EXPLORATION

The Golden Age of Exploration provides teacher information and student support materials for **The Seven Cities of Gold** computer software program which is a simulation of the Age of Exploration, 1492-1540. Teacher information includes how the program ties into the history-social science curriculum and a pictorial tutorial of the program. Student materials include integrated hands-on science activities, expedition assignments, maps of the historical Americas, and similar materials. These are excellent resources for gaining a feeling for the problems faced and solved by explorers. Excellent values education. Grades 5-9.

ROBOT'S ODYSSEY I

SETUP's **Robot Odyssey I** materials provide teacher and student reference materials to successfully engage students in building electronic robots which in turn serve various functions in solving problems posed at each of the five levels. Student materials offer suggestions on procedures as well as helpful hints. Teacher materials include suggested class procedures, classroom environment suggestions, solutions for each problem, maps for the five mazes, extensions involving logic gates and circuits, and binary adders. This program, supported by these materials, provides abundant challenging problem-solving activities that will enrich the experiences of the best students. Grades 5-12.

SLEUTHING ACROSS AMERICA

Sleuthing Across America provides teacher and student support materials for **Agent USA**, a software program from Scholastic, Inc., in which students travel around the United States via a simulated train network in order to catch a menacing FuzzBomb. U.S. geography, math, and problem solving skills are enhanced. Students will collect information, make and test hypotheses, and develop strategies while trying to solve the case. Included are suggestions for guiding the class through the problem solving experience, preliminary activities on time zones, and the location of U.S. cities, forms for recording information gathered while using the software, extended activities, and answer keys. Grades 5-8.

Two New AIMS Books To Be Published

Two new books in the Project AIMS series are scheduled to be released this fall—Book 9, **Out of This World**, to be published in October; and Book 10, **Probably So!**, to be released in November.

Out of This World features a study of our solar system. It consists of fifteen investigations, many of them novel, that study the planets. Two features new to the Project AIMS series are introduced in this publication for the first time: facts sheets and a planet trivia game. Fact sheets are presented in the same informal, hand-lettered format as the other student pages and are intended to provide the latest information available about the planets, including the discoveries made from recent flybys. Some of these facts add considerably to our previous knowledge. The planet trivia game includes forty-five interesting and timely facts.

The book includes investigations such as: What Can You Show? What's My Size? How Many Moons? Planetary Facts, Spacing Out the System, Solar Distance, Solar System Model, Size It Up, Extra Terrestrial Excursions, How Long Does It Take to Say Hello? Space Talk, Weight in Space, Space Feet, and Space Throw.

Probably So! is the first of a two-volume series that treats the topics of probability and statistics. It is also the first AIMS publication in the "Big Book" series. This series is so named because of the larger number of investigations and the extended treatment accorded some of them. The price per volume in the "Big Book" series is $15.95.

Included in **Probably So!** are investigations such as the following: A Definite "Maybe"; Scissors, Rock or Paper? Fair Play; Good Order Solves a Mystery; Word Sense; What's In a Name? Get the Message? Getting Into Step; Thumb's Up; Radio Raves; T.V. Ad-Venture; Watch What You Eat; Peanut Butter Crunch; Citrus Search; Raisinably Sure; M&M Mix-Up; M&M Secret Choice; MMM Randomly Delicious; At the Crossroads; Test the Test; Marbelous Rolls; and Coin-Age.

Introducing Project AIMS

MATHEMATICS AND SCIENCE are currently the focus of national concern. Everyone—government officials and parents, teachers and students, test makers and administrators—has something to say about these two disciplines. Such interest and concern is only natural and necessary in today's world of micro-computers, nuclear energy, space exploration, and process communication.

As our rapidly developing technologies are creating new potentials for the future, they are simultaneously generating new challenges. As educators we are right, therefore, to be concerned when our students do not seem adequately competent, comfortable, willing or prepared to utilize mathematics and science as tools to deal with today and to build tomorrow.

The National Science Teachers Association recently reaffirmed the idea that learning science process skills and developing scientific attitudes requires the use of activity-oriented investigative teaching methods. If, indeed, we want children to understand science, they need to have many opportunities to observe, to experiment, to wonder, and to say "what if...?" If they never wonder, they'll never know science. But becoming a scientist is not merely the accumulation of facts. Rather it is becoming skillful in coordinating information and recognizing relationships. The natural relationship that exists between math and science encourages us to communicate and share those relationships through the universal language of mathematics.

Project AIMS seeks to meet the challenge of providing curricular materials that integrate math and science in a way that is mutually stimulating and meaningful for the teacher and the learner.

WHY INTEGRATE MATH AND SCIENCE?

First, mathematics and science are naturally integrated in the real world and, therefore, should be so integrated in the classroom.

Curriculum experts have long recognized that such an integration in school, patterned after the real world model, makes eminent sense and holds great promise for making the study of mathematics meaningful and interesting; and the study of science more realistic, extensive, and immediate. Although current textbooks, schedules, teacher training, and tradition conspire to isolate these two fields, Project AIMS materials establish an intrinsic working relationship between them.

Second, significantly, as in the real world, a whole series of math skills and science processes are interwoven in a single activity, creating a continuum of experience, practice, and application rather than an artificial, isolated exposure.

Thus, the two disciplines combine to not only increase the extent to which science is studied, but also to extend the way in which it and mathematics are studied.

Third, the materials capitalize on the student's natural curiosity and eagerness to investigate by presenting key questions that relate directly to the student's real world.

Concepts grow from these concrete experiences and flourish in the "What if...?" environment as students apply mathematics to familiar situations and begin to visualize its application to more challenging problems.

As the student becomes more involved in the scientific progression from observation to hypothesis-making, from experimentation to abstracting to theorizing, he comes to care less about the easy answers and more about the complex questions. He is, in fact, becoming a creative problem solver, able to visualize possibilities and implications, able to utilize a variety of resources and strategies, and able to rely increasingly on his own abilities and knowledge to find both viable solutions and further questions.

Fourth, given the freedom to act, the student is transformed from an observer of the teaching process to a participant in the learning process.

As classroom experiences have demonstrated, the results of this transformation is enhanced by the importance of the role in the exploration and by the ability and responsibility to control the experience. Since certain skills are needed frequently, the child receives constant and effective reinforcement as well as an appreciation of the role that individual skills play in a comprehensive investigation. The student's retention is maximized due to the direct involvement in a hands-on experience.

Since the materials are student-centered, the child develops responsibility for both the group experience and its own learning. Through such involvement, the student learns to think critically, to hypothesize and plan, to analyze and synthesize, to work cooperatively and independently.

Fifth, the investigations are enjoyable, and any students learn more, more effectively when the process is enjoyed!

Field testing of the materials has produced a consistent report: students enjoy doing math and science in this way. Often the math content is far more intensive than that encountered in any other mode but because students are so involved in the total process they will respond by saying, "It sure was fun not to have math today!"

Project AIMS is, above all, a dynamic, expanding idea; not an ultimate or ultimatum. Its task is not completed, just begun. All net proceeds are placed into an AIMS Education Foundation trust fund to be used exclusively for the support of continued research and development of integrated math-science materials. Often, this takes the form of scholarships to classroom teachers who participate in a succession of writing projects producing new AIMS materials as team members with Fresno Pacific College Math/Science Project faculty.

THE FORMAT AND THE FACTS

Each volume consists of two components: a teacher's manual, which contains all necessary information about the investigations and how to prepare for them; and a student manual, which contains the recording sheets and written or pictorial directions for each activity.

BOOKS AVAILABLE

Grades 5-9 Series:

Book 1–**Math + Science, A Solution,** consists of twenty-five investigations taken from all subject matter areas.

Book 2–**The Sky's the Limit,** contains twenty-four investigations dealing with flying objects from paper airplanes to water rockets.

Book 3–**From Head to Toe** includes studies of the human body including functions and response of lungs and heart to various conditions plus skeletal structure.

Book 4—**Fun With Foods,** A Recipe for Math and Science contains a series of investigations utilizing and analyzing common foods.

Book 5—**Floaters and Sinkers** contains studies of objects that float or sink under a variety of conditions and the reason why. Excellent for junior high school.

Book 6—**Down to Earth** contains studies in earth science including a final comprehensive unit dealing with prospecting to find the composition of a hill built by students.

Book 7—**Our Wonderful World** includes studies dealing with the environment, utilizing readily accessible materials.

Book 8—**Pieces and Patterns, A Patchwork in Math and Science** is a fascinating collection of a variety of activities from Shadows and Sundials to Kaleidoscopes and Turtles.

Book 9—**Out of This World** (see page 25 for description). Publication date: October, 1986.

Bk. 10—**Probably So!** (see page 25 for description). Publication date: November, 1986.

Grades K-4 Series:

K-1 **Fall Into Math and Science** (Book 1) is a collection of experiences that relates to the fall season of the year and its holidays...from Apples-A-Peel to Me to Spinning Ghosts.

K-1 **Glide Into Winter With Math and Science** (Book 2) includes activities that reflect the joy and wonder of winter and its holidays including Christmas and a life size Gingerbread Boy.

K-1 **Spring Into Math and Science** (Book 3) contains "spring-like" experiences and includes everything from bunnies and eggs to rainbows and leprechauns.

2 **Seasoning Math and Science** (Book A) contains studies that deal with Fall and Winter and related holidays from seeds and beans to batteries and bird's nests.

SPRING INTO MATH and SCIENCE
Overhead and Underfoot
BOOK D
FALL INTO MATH and SCIENCE
HARDHATTING IN A GEO-WORLD
Seasoning Math and Science
JAW BREAKERS AND HEART THUMPERS
BOOK A

2 **Seasoning Math and Science** (Book B) rounds out the study of the seasons with the addition of Spring and Summer activities for second graders.

3-4 **Jaw Breakers and Heart Thumpers** (Book A) combines the study of fun foods and body basics in such activities as Gimme Five and By Golly, By Gum.

3-4 **Hardhatting in a Geo-World** (Book B) explores the mysteries surrounding skyscrapers, bridges, one-sided paper and bubble planes through the study of structures and design.

3-4 **Popping With Power** (Book C) contains activities that deal with energy sources and conservation from Save-A-Watt to Polar Brrs...

3-4 **Overhead and Underfoot** (Book D) is full of weather and natural environment studies that give students experience with cloud formations, relative humidity, rainfall and shadows.

ORDER INFORMATION

Send all orders and remittances to:
AIMS Education Foundation
P.O. Box 7766 · Fresno, California 93747

The following are currently available:
Please order by book number and title.
Correlations to the California Science Framework Addendum for grades K through 9 are available for $9.

Grades 5-9 Series:

Book 1—Math•Science, A Solution	$10.95
Book 2—The Sky's the Limit	10.95
Book 3—From Head to Toe	10.95
Book 4—Fun With Foods	10.95
Book 5—Floaters and Sinkers	10.95
Book 6—Down to Earth	10.95
Book 7—Our Wonderful World	10.95
Book 8—Pieces & Patterns, Patchwk in Math & Sci	10.95
Book 9—Out of This World	10.95
Book 10-Probably So!	15.95

NOTICE:
—All California orders must add 6% sales tax.
—All orders will be charged a 10% shipping-handling fee.
—Schools may use purchase orders.
—Each book consists of Student and Teachers's Manual.

Grades K-4 Series:

K-1	Fall Into Math and Science, Bk. 1	$10.95
K-1	Glide Into Winter w/Math & Sci., Bk. 2	10.95
K-1	Spring Into Math and Science, Bk. 3	10.95
2	Seasoning Math & Sci., Bk. A (Fall & Winter)	10.95
2	Seasoning Math & Sci,. Bk. B (Spr.-Summer)	10.95
3-4	Jaw Breakers and Heart Thumpers, Bk. A	10.95
3-4	Hardhatting in a Geo-World, Bk. B	10.95
3-4	Popping With Power, Bk. C	10.95
3-4	Overhead and Underfoot, Bk. D	10.95

Note: purchase of books entitles school to make 200 copies of student manual pages for classroom use.

Science Poster Series:

Set A	$10.95
Set B	10.95
Set C	10.95
Set D	10.95
Set E	10.95
Set F	10.95

Mathematics Posters Series:

Set A (Available September, 1986)	$10.95
Set B (Available October, 1986)	10.95
Set C (Available October, 1986)	10.95
Set D (Available November, 1986)	10.95
Set E (Available November, 1986)	10.95
Set F (Available September, 1986)	10.95

Project SETUP Books:

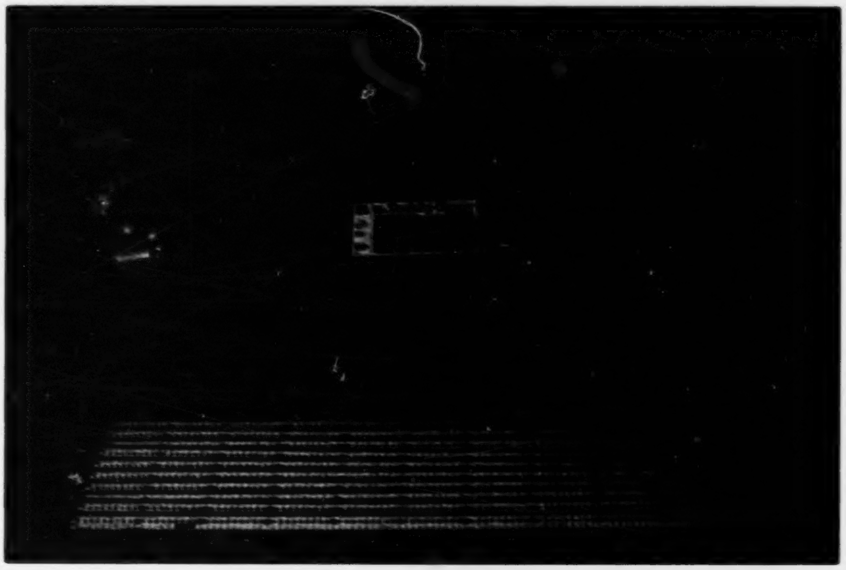
Rocky's Circuits	$10.95
The Golden Age of Exploration	10.95
Robot's Odyssey I	10.95
Sleuthing Across America	10.95

PROJECT AIMS LABORATORIES

'Activities that Integrate Math and Science'

These AIMS laboratories have been designed by the Program Directors of Project AIMS to provide the basic equipment needed for Project AIMS investigations...both those already published and those to be published. They are configured for maximum utility and cost-effectiveness.

K-4 PROJECT AIMS LABORATORY . . . . . . ● 9750 $369.15



CONTENTS

LENGTH MEASUREMENTS	
30	Primary 30cm Rulers
30	150cm Tape Measures
10	Meter Sticks
VOLUME MEASUREMENT	
1	Metric Measuring Cup Set
1	Metric Spoon Set
5	Liter Boxes with Lids
MASS MEASUREMENT	
5	Primer Balances
5	Round Stacking Mass Sets
2	Bar Mass Sets
TEMPERATURE MEASUREMENT	
10	Immersion Thermometers
MULTIPLE USES	
500	Teddy Bear Counters

GRADES 5-9 PROJECT AIMS LABORATORY . . . ● 9751 $541.25

CONTENTS

LENGTH MEASUREMENT	
30	All-purpose 30cm Rulers
30	150cm Tape Measures
10	Meter Sticks
1	10mm Windup Tape
VOLUME MEASUREMENT	
2	Advanced Beaker Sets/5
1	Metric Measuring Cup Set
1	Metric Spoon Set
5	Liter Boxes with Lids
1	Graduated Cylinder Set/6
MASS MEASUREMENT	
5	School Balances
5	Round Stacking Mass Sets
2	Bar Mass Sets
200	Centicubes
2	Spring Scales/250g
2	Spring Scales/500g
TEMPERATURE MEASUREMENT	
10	Immersion Thermometers

ORDER THESE PROJECT AIMS LABORATORIES
from the
AIMS Education Foundation
P.O. Box 7766 • Fresno, California 93747
Add 10% for shipping and handling. California residents add 6% sales tax.

The AIMS Education Foundation

announces the

AIMS National Leadership Program in Mathematics and Science

AIMS

FRESNO PACIFIC COLLEGE

FEATURING:

- Unique opportunity for school wide program of staff development in mathematics and science
- In-depth training in the integrated mathematics-science approach of Project AIMS
- Intensive study in math-science content, processes, problem solving, and teaching methodologies under nationally recognized leaders in math and science education
- Consistent focus on combining content instruction with integrated hands-on and situational lesson experiences
- Program includes a wide array of special materials—AIMS books, video tapes, Math and Science Posters, SETUP publications, and much more
- Opportunity for membership in AIMS National Leadership Network

Introduction

The **AIMS National Leadership Program** will provide training in science and mathematics for selected teachers in grades K-9 using the integrated mathematics/science approach of Project AIMS. This program will provide intensive training in the physical, biological, earth science, and mathematics topics and the science process skills.

Participants will receive 300 hours of instruction during this two summer program sequence. Participants may enter the program during any summer. Each teacher selected will share this instruction during the following academic year with six or more teachers in the local district or region. Participants will provide a minimum of 50 hours of such instruction per academic year during the two-year program.

Participants for this Program will be selected on a competitive basis as outlined in the attached application form. Upon successful completion of this program, participants will qualify to become members of the **AIMS National Leadership Network**. Such membership qualifies the trainer to conduct Project AIMS workshops, teach AIMS in-service courses for college credit, and serve as a Project AIMS consultant to help meet the widespread and growing demand for such services.

Program Information

Location and Schedule

The program components are: two sessions of the AIMS National Leadership Institute (one per summer); the Science Festival; and the Festival of Mathematics. Each is an intensive two-week program which will be available every summer. All programs are offered on the Fresno Pacific College campus where excellent air-conditioned classrooms and residence facilities are available.

Participants may follow either a Schedule A or Schedule B sequence.

Schedule A

First Summer: Festival of Mathematics
AIMS National Leadership Institute
Second Summer: AIMS National Leadership Institute
Science Festival

Schedule B

First Summer: AIMS National Leadership Institute
Science Festival
Second Summer: Festival of Mathematics
AIMS National Leadership Institute

The schedule for the summer of 1987 is as follows:
Festival of Mathematics, June 22-July 3
AIMS National Leadership Institute, July 6-17
Science Festival, July 20-31

The schedule for the following summers will approximate the above.

Program Activities

For California residents, the program content is driven by the Science Framework Addendum, Mathematics Framework, the physical science recommendations in the Model Curriculum Standards, and the rationale and content of the CAP tests. Where out of state participants are involved, special attention will be directed to the respective state frameworks, testing instruments, and curriculum guides. Major topics in physical, biological and earth science, and in mathematics will be covered by specific instruction and related hands-on experiences. The overall approach will be in a manner and in language appropriate to the needs of elementary/middle school teachers, taking into account possible knowledge deficiencies, fear of hands-on activities and divergent thinking, feelings of insecurity in mathematics or science content, and the need for classroom management information and evalualtion procedures.

The full resources of Project AIMS, including all of the new activities now under development, will be brought to bear on this program. The exciting and pioneering materials emerging from Project SETUP (Software Evaluation and Teaching Utilities Program) will be included. SETUP materials consist of a score of problem solving, simulation computer programs that are fully supported by appropriate and essential materials developed at Fresno Pacific College, and which help to integrate these programs into the on-going curriculum.

Materials Description and Program Cost

The cost for the materials and the basic instructional fees for this program is over $4500. However, the AIMS Education Foundation is making a major contribution that reduces the program cost, without college credit, to $2600 per participant! This special reduced price is available exclusively to the participants selected for this program. Individuals taking the program for college credit would pay an additional tuition fee.

(continued on page 32)

APPLICATION

(Application may be photocopied)

AIMS National Leadership Program in Mathematics and Science

This application is intended for district endorsed applicants to the AIMS National Leadership Program.

NAME OF APPLICANT ______________________________

Address ______________________________

____

School ______________________________ Grade Level ____________

School Address ______________________________

____

Home Phone ____________________ School Phone ____________________

DISTRICT PERSONNEL ENDORSING AN APPLICANT:

Name ______________________________ Position ____________

School District ______________________________

Address ______________________________

____

Telephone ______________________________

FUNDING SOURCE: (Check one) ☐ Applicant ☐ School District:

Complete the following if District funded:

Funding authorized by ______________________________

Title or Position ______________________________

Address ______________________________

____

APPLICATIONS SHOULD BE SUBMITTED TO:

AIMS Education Foundation • P.O. Box 7766 • Fresno, CA 93747

Application Information

The accompanying application must be filed at least two months prior to the beginning of a program. Applicants will be informed of their acceptance within 30 days after the filing of an application. The number of participants is limited. Therefore, early filing is important.

The preferred response is one in which the school district uses this as a way to implement a school-wide program of staff development in mathematics and science, particularly the integrated approach, and funds the participation of one or two teachers. Where two teachers are selected from the same school or district, each will receive the full complement of materials. In addition, that district will be granted duplication rights to the video-tape series for use in the district only. However, it is possible for individuals to fund their own program with the goal of becoming actively involved in the AIMS National Leadership Network. In either case, there must be district endorsement and a commitment of at least six teachers to take 50 + hours of training during each academic year following a summer's program.

MATERIALS DESCRIPTION/PROGRAM COST (continued from p. 30) The materials included are the following:

1. **Video-Tapes.** The faculty is preparing a series of 24 half-hour video-tapes to be released progressively during the two-year period. These will provide full coverage of the philosophy; underlying learning theory and model of mathematics; classroom management modes; evaluation processes; science processes; selected science, mathematics, and problem solving demonstrations that are inherent in Project AIMS and Project SETUP; and teaching methodologies. The tapes will be an excellent and permanent means whereby local teachers can constantly review critical elements of the program. They will be excellent aids for local in-service programs.

2. **New Project AIMS Books.** Currently, two writing teams of 30 teachers each are working with the Project AIMS Program Directors in the development of new materials to be published in 10 or more Project AIMS books. These will be provided to each participant.

3. **Science and Mathematics Poster Series.** Project AIMS is currently developing two poster series of 100 posters each, one in mathematics and one in science. These are designed to encourage independent investigation, often together with parents at home. This is to encourage parental involvement in the education of their children as a support to the school. Another purpose is to entice students, particularly gifted students, into learning activities in addition to those that are assigned. Each 15" × 20" poster is attractively designed and each has an accompanying 8.5" × 11" blackline master that is a reduction of the poster. Also included is general information for the teacher and suggested procedures and applications.

4. **Special Materials.** The Fresno Pacific Math/Science faculty has developed special materials to help students with topics ranging from basic facts mastery to problem solving in mathematics. These will be provided to participants.

5. **Project SETUP Books.** Each participant will receive 10 of the Project SETUP books to be published during the next two years. These support specific carefully selected commercial computer programs that emphasize problem solving. Support books for such programs as Rocky's Boots, Robot Odyssey, Agent USA, Seven Cities of Gold, etc., are included. In addition, participating schools will be able to purchase selected software at significant discount.

The total program cost, without college tuition, is $2600 due to the subsidy from the AIMS Education Foundation. The program may be taken with or without college credit. If taken for credit, participants can earn 16 semester units of graduate credit applicable, if desired, to the Master of Arts in Education degree, Math/Science Emphasis. The extra total tuition fee for 16 semester units of credit is $360.

Payment Schedule

The first payment of $1300 is due 30 days before the first session selected by the participant. The second payment of $1300 is due one year later.

Room and Board

Room and board for the Festivals and Leadership Institutes are not included in the $2600 cost. Single occupancy room plus board is $28 per day and double occupancy is $20 per day in 1986. Comparable rates can be expected for 1987 and 1988.

Special In-Service Tuition Rates for Local Teachers

A significant element of the program is the subsidized program of instruction in the local district or region for local teachers. Each participant is required to provide 50+ hours of instruction during each of two academic years as part of the training. Teachers taking this training from an AIMS Leadership Program participant may do so with or without credit. Where college credit is desired, teachers may earn one semester unit of in-service credit for each 16 hours of instruction received. If the course work is taken through Fresno Pacific College, a special reduced tuition rate of $30 per semester unit, one-half the regular tuition, will apply. In addition, such teachers will receive one Project AIMS book of their choice at no cost for each unit of credit earned.

Questions or concerns may be directed to Dr. Arthur Wiebe or Judith Hillen, Project AIMS Directors, AIMS Education Foundation, P.O. Box 7766, Fresno, CA 93747 or by calling (209) 453-2024.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

BULK RATE
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation

Volume I, Number 2 September, 1986 ©AIMS Education Foundation

Hesitant to Teach Hands-On Science?

Judith A. Hillen

You are not alone. When AIMS began five years ago under a National Science Foundation grant, we attempted to address the question: Why aren't elementary teachers teaching science in their classrooms? This is what we heard and what we are continuing to hear. "I haven't got enough time." "I don't have the proper equipment or an appropriate textbook." If you have a textbook that says that someday we'll have a man on the moon, you understand that complaint. Most frequently and very openly teachers confessed, "I'm not really qualified to teach science. I took only one science course in preparing to become a teacher, and that course was a methods course rather than a content course." The message is loud and clear. Generally speaking, teachers are feeling unprepared and anxious about teaching science in the classroom.

The general public tends to feel that science is synonymous with biology, chemistry, physics, geology and the list continues. At all grade levels, science encompasses more than those content areas. Science education used to be predominantly listening, reading and watching. Science should be: (1) active investigating, (2) recording and relating information, and (3) students discovering and sharing ideas.

A scientist does not prove himself a scientist by accumulating facts, memorizing the Periodic Table or reciting Newton's First Law of Motion. It is rather his ability to organize and coordinate information and recognize realtionships that makes him unique. Therefore, we are encouraging teachers to re-examine their science curricula and ask themselves: What will inspire them to be curious about their world? How can we teach them to communicate factually and to question creatively? If students are to understand and appreciate science, they need many opportunities to explore, experiment, and wonder. If they never wonder, they'll never know science. We loosely call these abilities, science process skills or "doing" the job of the scientist. The California State Science Framework Addendum lists these processes and charts them effectively with content areas and developmental stages. The skills listed are: observing, communicating, comparing and measuring, organizing, relating, inferring, and applying. Within these broad areas are more specific skills such as data gathering and sequencing, contolling and manipulating variables, recognizing patterns, and generalizing and using knowledge to solve problems. When the learner becomes so engrossed in "doing as the scientist does", the rewards are many. The student becomes motivated to become involved in the learning process. He sees practical, real world applications of math and language arts skills. The "doing" process also encourages those students with poor reading ability to actively participate in this non-reading activity and feel very successful. When students work cooperatively in discovery oriented

(continued on page 5)

Mathematics Conferences Offer Growth Opportunities

California teachers will find many opportunities for professional enrichment in eight mathematics conferences scheduled in the state for 1986-7.

The NCTM Annual Conference is slated for April 8-11 in Anaheim. For information contact Bob Hamada, (213) 430-5629.

The California Math Conference Central Section will convene at Fresno Pacific College, Fresno, California October 17-18. Fresno Pacific College faculty appearing on the program include Larry Ecklund, Judith Hillen and Arthur Wiebe. For information contact Dee Brown, (209) 578-0538.

The CMC Southern Section Conference will convene in Long Beach on November 21-22. Judith Hillen and Arthur Wiebe will present a mini-conference strand on Project AIMS and Wiebe will make a second presentation on "Problem Solving in Middle School." Program requests should be directed to Joan Akers, 6401 Linda Vista Road, San Diego 92111-7399.

The Northern Section Conference of CMC will meet at Asilomar December 5-7. Judith Hillen and Arthur Wiebe will be presenting new AIMS activities. Six Fresno Pacific College alumni will also make presentations: Ron Falk on "Computer Software—Robotics"; Rita Scott discussing "P.S. Let's Get Married"; Fran Threewit presenting a workshop entitled "Math Activities vs. Anxieties"; Susan Dixon speaking on "Writing Across the Curriculum"; Sandra Crepps on "Author, Author"; and Jim Wilson on "Using ROCKY'S CIRCUITS to Energize ROCKY'S BOOTS." The contact person is Roberta Koss at (415) 472-1728.

Conferences scheduled after the first of the year include the Stanislaus Mathematics Conference in Turlock, the Greater San Diego Math Council sessions in San Diego, LACTMA Conference at Loyola Marymount, and the CMC Northern Section Spring Conference in Sacramento. Additional information on these will be published in a subsequent Newsletter.

Dr. Arthur Wiebe will make an AIMS presentation at the California Science Teachers Conference in Sacramento September 27.

AIMS Leadership Network Introduces Kim Sutton...

Kim Sutton enthusiastically invites teachers to become involved in Project AIMS. Teachers in Tehama, Glenn, Siskiyou, Humboldt, and Del Norte counties are experiencing the joy of teaching hands-on math and science through the dedicated efforts of Kim Sutton. Her lessons have been so successful that recently a local television station elected to feature her and her classroom on a broadcast of public interest. The show entitled "What Did You Do In School Today?" highlighted use of AIMS in the classroom and the students eager involvement in the activities.

Kim is currently teaching a combination 5th-6th grade class at Lincoln School, Eureka, California and has had cumulative experience at grades 2, 4, and 6 in McKinleyville including a Mentorship position.

During the Summer '86, she was able to join the Fresno Pacific Math Faculty in conducting AIMS Workshops on the Fresno Pacific College campus where workshop attendance reached nearly 100 participants per weekly session.

Kim's educational background includes a Bachelor's degree and California State Teaching credential from Humboldt State University in 1977 and a Masters degree in Education with an emphasis in Mathematics and Science from Fresno Pacific College in April, 1985.

Kim Sutton explains a "Bear Fact" graphing experience.

Upcoming workshops to be led by Kim include Del Norte County in September and October and Humboldt County in October. We are pleased and proud to have Kim as a member of the AIMS Leadership Network.

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California 93727. Volume I, No. 1.

©1986 AIMS Education Foundation

EDITORS	Arthur Wiebe, Judith Hillen
STAFF ARTIST	Sheryl Mercier
OFFICE MANAGER	Sheryl Bishop
PROGRAM DIRECTORS:	
Fresno Pacific College Math/Science Project	Lawrence E. Ecklund
AIMS Education Foundation	Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes	Ted Ostrander
Project AIMS	Judith Hillen, Arthur Wiebe
Project SETUP	Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION

PRESIDENT	Arthur Wiebe, Ed.D.
VICE-PRESIDENT	Wilbert Reimer
SECRETARY	Lawrence Ecklund
TREASURER	Jon Hillen
ACCOUNTANT	Robert J. Dwyer
STAFF ARTIST	Sheryl Mercier

• THIS ISSUE • THIS ISSUE • IN SUMMARY • THIS ISSUE • THIS ISSUE •

Introducing Kim Sutton, member of the AIMS National Leadership Network

This if the first in a series of articles introducing members of the AIMS National Leadership Network and their activities in the AIMS Program. Members of the Network can be scheduled for workshops or courses through the AIMS Education Foundation. **Story on Page 2.**

"Golden Age of Exploration" Features Social Studies

Martin Suey, the author of "Golden Age of Exploration", shows how the software program "The Seven Cities of Gold" supporting the collection of activities in his book can provide a stimulating and effective social studies unit. **Story on this page.**

Fresno Unified Integrates AIMS Into Math and Science Programs

This is the second in a series of articles reporting on how school districts are implementing AIMS in a carefully designed, systematic manner. **Story on Pages 4-5.**

Introducing the Model of Mathematics

What does it mean to really be teaching mathematics? Is there a larger view from which we can make decisions? In this first in a series of articles Dr. Arthur Wiebe discusses the nature of the Model of Mathematics and how it can influence mathematics education. **Article on Pages 6-7.**

Your Students Can Be Problem Solvers!

Wilbert Reimer discusses Level II type solutions in this second article in the series on problem solving. **Article on Pages 8-9.**

"Regions, Arcs, and Corners" Poster Provides Problem Solving Challenge

This problem provides an excellent opportunity for open-ended exploration that is sure to excite your students. Generalizing the result is an excellent study of patterns. The poster is the contribution of Wilbert Reimer. Sheryl Mercier is the artist. **Poster on Page 10.**

"The Covered Candle" Is This Month's Science Poster

The poster information was developed by Harold Silvani and the poster designed by Sheryl Mercier. **Poster and instructions on Pages 11-12.**

Three Project AIMS Activities Span K-9

This issue features three new AIMS activities: **Gummy Bears** for Grades K-2 (Pages 13-18); **Bear Facts** for Grades 3-4 (Pages 19-22); and **Peanut Butter Crunch** for Grades 5-9 (Pages 23-29). **Peanut Butter Crunch** includes a new feature that will be standard in the new books now being written—Fact Sheets. Fact Sheets are being added to provide further background information to students and teachers alike. In this case there is a discussion of basic facts about peanuts and a drawing of how peanuts grow on the plant. In future editions of the **Newsletter** four new activities will be presented where space permits.

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ____________________

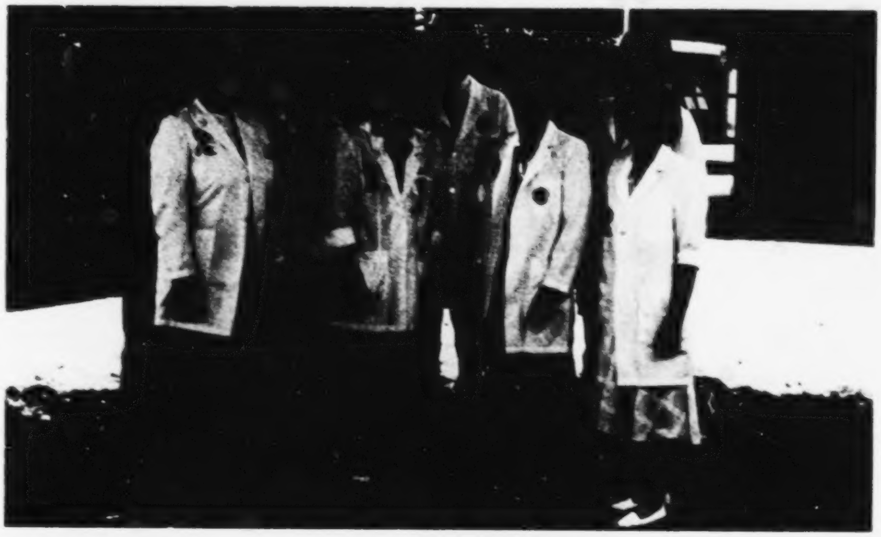
Address: ____________________

Street City

____

State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747



Members of Fresno Unified's Science specialist Team from left to right are Evelyn Hoover, Care Butler, Jeri Starkweather, Howard Larimer, Sheryl Mercier, Mike Walsh, and Sharon Magnuson

Fresno Unified Integrates AIMS into Science and Math Programs

The Fresno Unified School District has developed two innovative curriculum projects: a mathematics program that focuses on problem solving and a science program that stresses the hands-on approach. Gail Robinette heads the mathematics program and Harold Silvani the science program.

In the Spring of 1984 the Fresno Unified School District funded a three year science project designed to prepare teachers to offer quality instruction in K–6. The program was developed after curriculum personnel consulted with the science unit in the California State Department of Education and visited districts using traveling science teams.

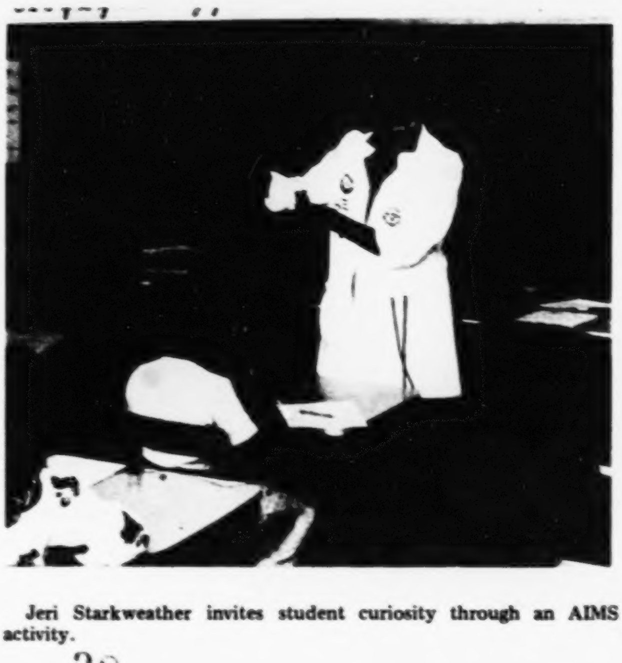
Fresno Unified elected to utilize an in-the-classroom inservice approach. Under this format fourth, fifth, and sixth grade students would receive instruction from science specialists 33 weeks during the year while the classroom teacher was free to observe the lesson. Six teachers were hired to serve as intermediate grade science specialists: Betsy Olson, Care Butler, Mike Walsh, Evelyn Hoover, Sheryl Mercier, and Jeri Starkweather.

From its inception the Elementary Science Project utilized Project AIMS materials extensively. Two of the specilists, Sheryl Mercier and Jeri Starkweather were members of the original NSF funded AIMS Grades 5–8 writing project and Betsy Olson participated as writer in the K–4 AIMS writing project. Sheryl Mercier and Betsy Olson were the principal illustrators.

The pre-service and first year professional growth component for the specialists included a variety of workshops: two days using SAVI-SELPH programs presented by Larry Malone and Linda DeLucci from the Lawrence Hall of Science; four days with SCE-CIE Director Herb Strongin; four days with Del Alberti focusing on a science curriculum integrated with other curricular areas; one day with Ed Youngman; and participation in regional science conferences.

In addition, each specialist spent one week visiting other key district programs for the purpose of achieving maximum articulation between elementary and middle school science programs.

During the school year, each specialist taught five weekly lessons in 20 project classrooms reaching a total of 120 classrooms and 3600 students. Prior to teaching a lesson, the classroom teacher was provided a set of lesson plans which included concepts keyed to the California State Framework Addendum with suggestions and materials for follow-up activities. Each specialist presented a total of 33 lessons during the year, eleven each in

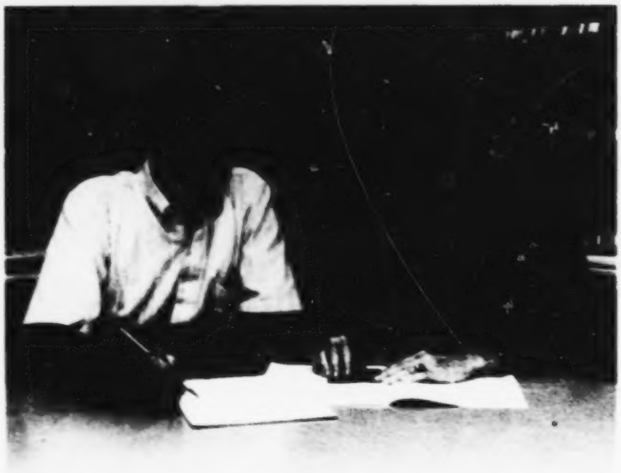


Jeri Starkweather invites student curiosity through an AIMS activity.

biological, earth, and physical science. Because the FUSD program focuses on a hands-on approach integrating other areas of the curriculum, Project AIMS materials were ideal.

The second year program followed the same format with one significant change: Sheryl Mercier was assigned to the position of Elementary Science Resource Specialist. She provided follow-up services to the first year project schools and assisted the other specialists in developing lessons and units for presentation. Howard Larimer was added to the team from a slate of eight candidates. Each applicant was required to present a 30-minute classroom science lesson, observed by the screening committee, followed by a 15-minute follow-up conference/interview, a procedure that is highly recommended for positions that require the presentation of demonstration lessons.

During the third year, the emphasis is to present lessons keyed to both the framework and the adopted science textbooks. By June of 1987 the science specialists will have in-serviced over 345 fourth, fifth, and sixth grade teachers while presenting weekly lessons to over 10,000 students.



Harold Silvani, Science Curriculum Coordinator, and Gail Robinette, Mathematics Curriculum Coordinator, plan the integrated math/science program.

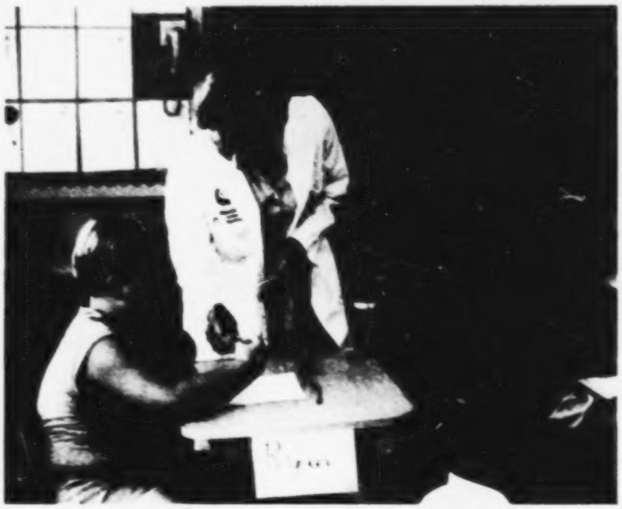
Recognizing the need to continue building a strong elementary science curriculum, the administration and board authorized all schools to purchase science textbooks for every K–6 classroom.

Another major effort to improve science instruction while integrating mathematics and other areas of the curriculum has been the cooperative effort of the elementary math and science coordinators, Gail Robinette and Harold Silvani. Under their leadership 128 elementary mathematics and science representatives from the 58 FUSD and four private schools attended a series of Project AIMS Workshops conducted by Larry Ecklund, Judith Hillen, and Dr. Arthur Wiebe of the AIMS faculty. Participants were in-serviced on the suggested implementation of AIMS activities and participated in hands-on experiences.

Each of the schools received a complete set of Project AIMS books and the necessary materials and equipment for classroom implementation. These in-services, which concluded with the final session on September 22, were funded through PL98-377.

For the summer of 1986 Gail Robinette and Harold Silvani selected seventeen key math and science teachers to participate in the AIMS National Leadership Program offered by the Fresno Pacific Math/Science Project. This was yet another cooperative effort between the math and science coordinators to provide teachers with the expertise to work with other teachers in using an integrated curriculum. These seventeen Trainers will conduct sixteen in-service sessions during 1986-7.

A future article will provide information on the problem solving program developed by FUSD under the leadership of Gail Robinette.



Sheryl Mercier checks with budding scientist.

(Hesitant to Teach - continued from page 1)

activities, teachers are freed from having to know all the "right" answers (being the sage on the stage). Instead, she becomes the "guide by the side", skillful in nurturing learners in a search for solutions. Students are now doing the sequencing, verbalizing and synthesizing.

The contributions of many teachers to the improvement of math and science curriculum through Project AIMS is a timely one. The National Science Teachers Association recently reaffirmed the idea that: "Learning science process skills and developing scientific attitudes requires the use of activity oriented investigative teaching methods." The underlying philosophy of Project AIMS is that children learn more effectively when they TOUCH the real world, than when they encounter it only through textbooks. They learn to think critically, to be good hypothesis makers and problem solvers. A major consideration is that the activities in Project AIMS, or any other hands-on program, are mutually stimuatlting for both the learner and the teacher, and that we are contributing to a broad base of remembered experiences where participants "do and understand" not just "see and hear" the answers. Be encouraged that if each of us does his share of inviting children to know science, collectively we are enhancing and enriching their lives.

A Model of Mathematics

Dr. Arthur J. Wiebe

How can we improve student experiences in and understanding of mathematics?

How can we maintain student interest in mathematics as they progess through the grades?

What can we do for students who have come to dislike the study of mathematics?

Does what we know about how children learn suggest that we need to make changes in the way we teach mathemaics?

How can we evaluate students as we move to higher order thinking skills and "situational lessons"?

These and other important questions facing us as classroom teachers will be addressed in this column.

What mathematics is of greatest value for students in K–9?

In today's schools, more and greater expectations are placed on classroom teachers to improve student achievement in mathematics and science. If teachers are to meet this challenge they must have the ability and freedom to make sound curricular decisions and to structure the daily mathematics and science experiences of students. The teacher knows the students best and is, therefore, the professional who should decide what is best for the students. To meet this responsibility requires that the teacher must have a firm foundation for intelligent curriculum decision making. Let us examine such a foundation.

Join with me as we soar far above the daily routine and the minutia of daily mathematics and science activities to gain a meaningful perspective by which we can select and design the math/science experiences for children. Our goal is to gain a bird's eye view of the mathematical enterprise. We will do this by examining a simple yet comprehensive Model of Mathematics that embodies all of the forms in which mathematics occurs in the real world and the basic processes it employs.

A mathematical model is a way of thinking about mathematics that can be shown in graphical form.

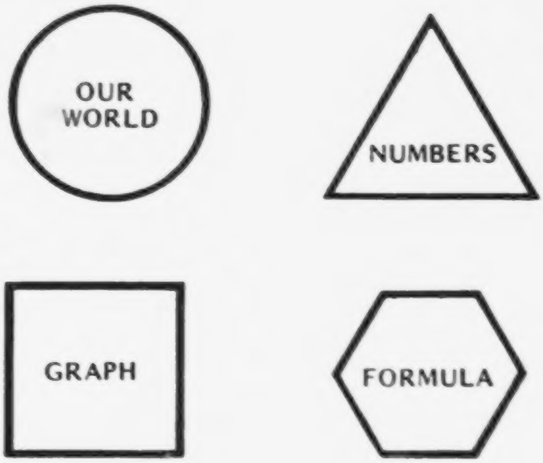
Underlying all of the AIMS and SETUP materials is such a model. The Model of Mathematics introduced here is a powerful and effective tool. It illustrates the interrelationship of concepts, provides a tool for analysis, and facilitates the development of useful new approaches to instruction. It helps the teacher and student to integrate mathematical concepts and processes that are otherwise disjointed. It ties specific skills, concepts, and processes together into a readily comprehensible whole; and the whole, in turn, enriches the meaning of each of its components.

Through the use of this model the teacher and student can gain a new perspective of mathematics that will enhance its meaning and reveal the beauty of mathematics as well as its utility.

The Model of Mathematics is simple yet comprehensive. It has demonstrated its effectiveness for generating new and innovative curricular materials that have strong student appeal and result in superior student performance. The Model incorporates all forms that mathematics takes both at the abstract and real world level. It incorporates learning theory as espoused by Piaget, Bruner, and Wirtz.

Best of all, it is easily understood by teachers and students and easy to use!

As shown in the illustration below, the Model consists of four parts illustrated by geometric shapes: a circle, triangle, square, and hexagon. *Mathematics comes in four and only four forms, each represented by one of these shapes.* It is this simplicity that makes the Model so useful.



The *Circle* represents the real world in which we move and work. Ours is a three-dimensional world. The circle speaks to us about the objects in our environment and the way in which we manipulate them. It is a most important beginning point for mathematical experiences in grades K–9. All manipulative activities are represented by it because they are real world experiences. It is the focal and terminal point of all applied mathematics. When a process begins or a concept is experienced in the real world, students are able to build a firm understanding and an appreciation of mathematics.

The real world contains countless objects and conditions, all of which have number properties. Take, for example, an ear of corn. We can ask many questions such as: "How many rows of kernels are there? Do all ears have the same number of rows? Is the number of kernels in each row the same? How long is the ear and how much does it weigh? What is the ratio of the weight of the kernals to the weight of the cob?

There are many properties in the real world which can be expressed in terms of counted or measured numbers: the passage of time in minutes; the value of labor in dollars; the loudness of sound in decibels; the pitch of sound in frequencies; temperature measured in degrees;

Lodi students are exploring the real world, represented by the circle in the math model.

rotation measured in degrees, minutes, and seconds; the intensity of light measured in lumens, etc. Each of these requires the use of some man-designed scale.

The *Triangle* represents an abstraction of the real world made through counting or measuring. We make scratches on paper to record the results in symbolical form. The symbols used in mathematical notation fall into three categories: numerals; operations such as +, ×, −; and the three possible relations =, <, >.

Another way to think of these three types of symbols is that

numerals represent *objects* with which we work;
operational symbols are *commands*; and,
the relations are the *results* or *consequences*.

The third element in the Model is the *Square*. The square is a pictorial or graphical representation. While it too is an abstraction, its form is very different from that of the triangle. The square may take the form of a graph, house plan, satellite photo of cloud conditions, map, photograph, drawing etc. Anything in which the real world is pictured in some fashion is represented by the square. It pictures a three-dimensional world in two-dimensional form.

The fourth element is the *Hexagon*. It represents a formula, hypothesis, generalization, pattern, or explanation. When we ask children, "What's my rule?" we are asking them to make a generalization of a pattern. A scientist or student "doing the work of a scientist" often observes an event and deduces a hypothesis or guess to explain the event. Such activity is represented by the hexagon.

The four forms of mathematics by the Model can be described by these action statements.

The *circle* depicts *doing*.
The *triangle* represents *writing*.
The *square* denotes *drawing or illustrating*.
The *hexagon* represents *thinking, finding the general rule*.

The Model suggests that students should regularly be engaged in doing, writing or recording, illustrating, and thinking that results in a generalization. Such content is in sharp contrast to an all too common assignment, "Turn to page 47 and do the odd numbered problems."

We have examined the four forms that mathematics takes. We can now begin to think about two questions:

What constitutes a genuine mathematical activity?

How can we structure learning experiences so that students will be engaged in genuine mathematics activities?

Once students have learned that mathematics takes on these four forms, they are ready to be introduced to the *movement among the forms*.

It is the mastery of each of these four forms and the movement among them that is the essence of mathematics.

It's time to graph, an activity represented by the square in the math model.

We want students to be able to begin with any one of the four forms and move to any of the other three with facility. For example, they may begin with an activity in the real world (the circle) and record counted or measured numbers (the triangle); draw a graph (the square); or explain what is happening (the hexagon).

There are four points for beginning a mathematical experience and each has a path leading to each of the other three. *It follows immediately that we have twelve ways of structuring an experience: four points of beginning and a choice of three paths from each.* When students can travel each of these twelve paths with competence they will truly understand mathematics! We turn our attention to these paths.

(to be continued in next issue)

Your Students Can Be Problem Solvers!

Wilbert Reimer

Level II Solutions

Another discovery we can make about the data in our table deals with the relationship between the numbers in the first and second columns. If we can discover what to do with the number in the first column, in each case, to obtain the number in the second column we have discovered another important insight into the problem.

This discovery we will call a Level II Solution.

The Level II Solution describes the horizontal relationship of the numbers in the table.

Definition: A Level II Solution is discovering what to do with the number in the first column, in each case, to obtain the number in the second column.

It is the rule that relates the two numbers.

Later we will offer some guidance to help students find these solutions.

But, for now, let's look again at our first example dealing with the sum of the first 100 counting numbers. What is the Level II Solution? That is, what would we do with the number in the first column to obtain the number in the second column? In this case the Level II solution is

1) Take the number in the first column
2) Multiply it by a number one larger
3) Divide the result by 2

In mathematical language our Level II Solution would be written as $n(n+1)/2$, where n represents any number in the first column.

What is the Level II Solution for the example above dealing with the sum of the first 50 odd numbers? It is

1) Take the number in the first column
2) Square it

Or, in mathematical language, we would write this as n^2.

Summary

Thus far we have outlined the heart of the Wishful Thinking Method of Problem Solving:

1) Reduce the problem to a number of simpler cases, usually collecting data in a table.

2) Obtain a Level I Solution by examining the vertical pattern in the second column.

3) Obtain a Level II Solution (horizontal) by discovering what to do with the number in the first column in each case to obtain the number in the second column.

Note:

Many problems can be adapted to various levels of ability. In some situations just ask students to discover a Level I (vertical) Solution. Most of the poster can serve as excellent problem solving experiences without going beyond the Level I Solution!

More capable students, however, might try to discover the Level II Solution and write the final result in mathematical language.

Some Hints For Discovering Level II Solutions

One helpful tool for discovering Level II Solutions is familiarity with the following three number sets:

1) perfect squares
2) triangular numbers
3) powers of two

Many problems will reflect these "families" of numbers or be related to them. We should take advantage of this in our problem solving.

In searching for a Level II Solution it is a good idea to initially allow students to explore on their own. They can use trial and error or any other ideas they have for finding the Level II Solution. There are frequently several equally good approaches to solving problems rather than one right way!

After attempting a solution on their own, some students may need some quidance. Here is a series of questions which can be helpful in finding Level II Solutions.

Helpful Questions For Finding Level II Solutions:

1. Are the numbers in the second column
   A. square?
   B. triangular?
   C. powers of two?
2. Are the increases for the numbers in the second column
   A. odd?
   B. consecutive?
   C. powers of two?
3. Do the numbers in the second column have a property in common?

How will these questions help? Let's look at some specific illustrations.

QUESTION 1: ARE THE NUMBERS IN THE SECOND COLUMN SQUARE, TRIANGULAR, OR POWERS OF TWO?

If the answer to this question is yes, it is usually a simple matter to discover the Level II Solution.

Example 1:

In this case the numbers in the second column are perfect squares and the Level II Solution becomes apparent.

1	1
2	4
3	9
4	16
5	25
n	n^2

Example 2:

In this case the numbers in the second column are triangular numbers and the Level II Solution reflects the formula for finding the value of the nth triangular number.

1	1
2	3
3	6
4	10
5	15
6	21
n	$n(n+1)/2$

Example 3:

In this case the numbers in the second column are powers of two and the Level II Solution incorporates this information.

1	1
2	2
3	4
4	8
5	16
6	32
n	2^{n-1}

QUESTION 2A: DO THE NUMBERS IN THE SECOND COLUMN INCREASE BY ODDS?

If so, they are related to the perfect squares in a special way, since the perfect squares increase by odd. Let's look at an example:

1	2
2	5
3	10
4	17
5	26
n	?

Notice that the increases in the second column are odd numbers. This tells us that the numbers in the second column are related to the perfect squares. A "helping column" to the right of the table will be useful here. We see that if we reduce each number in the second column by one, we obtain the perfect squares. The completed solution is shown below.

		Helping Column
1	2	1
2	5	4
3	10	9
4	17	16
5	26	25
n	$n^2 + 1$	n^2

QUESTION 2B: DO THE NUMBERS IN THE SECOND COLUMN INCREASE CONSECUTIVELY?

If so, they are related to the triangular numbers in a special way, since the increases of the triangular numbers are consecutive.

Here is an example.

1	3
2	5
3	8
4	12
5	17
n	?

The increases of the numbers in the second column are consecutive; therefore, the numbers in the second column are related to the triangular numbers. We set up a helping column, observing that we have to subtract two from each number in the second column to obtain the triangular numbers in our helping column. The complete solution is shown.

		Helping Column
1	3	1
2	5	3
3	8	6
4	12	10
5	17	15
n	$\frac{n(n+1)}{2} + 2$	$\frac{n(n+1)}{2}$

QUESTION 2C: DO THE NUMBERS IN THE SECOND COLUMN INCREASE BY POWERS OF TWO?

If so, they are related in a special way to the powers of two, since the powers of two increase by powers of two. Here is an example.

1	1
2	3
3	7
4	15
5	31

The increases of the numbers in the second column are powers of two; therefore, the numbers in the second column are related to powers of two. We set up a helping column by observing that we must add one to each number in the second column to obtain powers of two.

The complete solution is shown.

		Helping Column
1	1	2
2	3	4
3	7	8
4	15	16
5	31	32
n	2^{n-1}	2^n

(to be continued in next issue)

Solution To Regions, Arcs, And Corners

This problem gives students experience in the inductive process, that is, students are asked to observe a series of specific networks and, on the basis of their observations, form a generalization about all networks.

In this problem an "arc" is any curved or straight segment. A "corner" is a point from or to which an arc is drawn. Corners on this poster are designated by a dot.

The general solution is $C + R = A + 1$.

Regions, Arcs, and Corners

The figure to the right has 4 corners, 4 arcs, and 1 enclosed region. This information is recorded in the table.

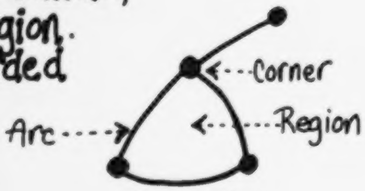


Figure #1

For each of the figures shown below, determine the number of corners, regions, and arcs. Record these values in the table.

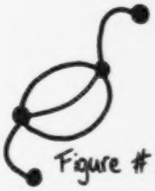


Figure # 2

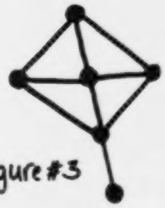


Figure #3

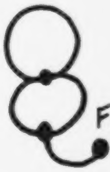


Figure #4

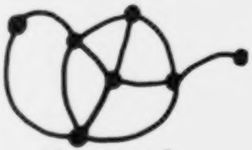


Figure #5

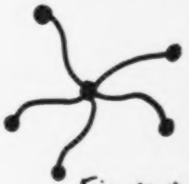


Figure # 6

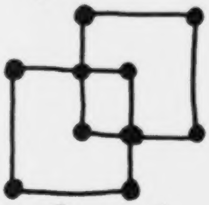


Figure #7

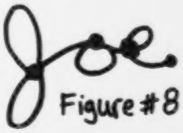


Figure #8

Figure	C Corners	R Regions	A Arcs
Figure #1	4	1	4
Figure #2			
Figure #3			
Figure #4			
Figure #5			
Figure #6			
Figure #7			
Figure #8			
Figure #9			
Figure #10			

EXERCISES

1. Write an equation relating C, R, and A.

2. Make up two figures of your own and enter the results in the table for "Figure #9" and Figure #10. Do your results agree with your equation?

THE COVERED CANDLE

GENERAL INFORMATION

Candles were man's chief source of light for at least 2,000 years. Over two thousand years ago crude candles were made of fats wrapped in husks or moss. Most modern candles are made of stearin, which is obtained from tallow, and paraffin, a mineral wax. Wicks are usually made of woven cord.

Candela is a standard for measuring the intensity, or strength of light sources. It was officially adopted in the United States in 1963. A 40-watt bulb gives off 31.36 candelas of light. The light that flows away from a light source is measured in **lumens**. The British standard candle was the first standard of light intensity. The candle was made from a white crystalline found in sperm whales and was exactly 7/8 of an inch thick. The amount of light given off by the candle was called one **candle power**. One candela is slightly less than one candle power.

As with anything that burns, candles must have a supply of oxygen in order to sustain a flame. When a burning candle is covered with a quart jar, no more oxygen can get into the jar so the flame will be extinguished when most of the oxygen trapped in the jar is consumed. As the candle burns, carbon dioxide is formed. Because carbon dioxide is heavier than air, it will begin to settle to the bottom of the jar. This will also help to extinguish the flame.

When a candle is burning, the flame is actually burning a gas that is produced by the melting paraffin. The "liquid" wax travels up the wick by capillary action and burns around and above the wick. To demonstrate that the gas, and not the wick, is burning, hold a lighted match and blow out the candle flame. Quickly lower the match to within a quarter of an inch of the wick. The gas will be ignited above the wick.

MATERIALS

Any kind of candles can be used, however it is important that the same type (made of the same kind of tallow or paraffin and size of wick) be used when conducting the extension activities.

PROCEDURE

When demonstrating this activity to the class, discuss safety procedures. Place the candle on a piece of aluminum foil and then form a base from clay in which the candle can be anchored. Have students predict what they think will happen. If they indicate that the candle will "go out" have them estimate how long it will burn before going out. Math can be integrated in the lesson by determining the range, median, and mode of the estimates.

POSSIBLE ANSWERS

1. Although many students will say that nothing was in the jar, it was filled with air.
2. About 20 seconds after the jar was placed over the candle, the flame was extinguished. This happened because most of the oxygen was consumed in the burning process.
3. If a larger jar (half-gallon or gallon) were used the candle would burn for a longer period of time.
4. If a shorter candle were used it would burn slightly longer.
5. This experiment demonstrates that something in the air (a gas called oxygen) is needed to sustain a flame.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Ask students if they ever have seen someone blow on a flickering fire to get it to start burning. This is done to move more air toward the flame. It is not the "air" from the person's mouth that feeds more oxygen, because much of the air coming from the mouth is carbon dioxide which will smother the flame. It's the air being moved between the mouth and the flame that helps feed the fire. If possible, show a picture of a bellows. Some students might have seen a movie on T.V. where a bellows was being used by a blacksmith.

1. Use two candles (same size and length) and a quart and gallon jar. Cover both candles at the same time. How much longer did the candle burn under the gallon jar than the quart jar? (It will not be exactly 4 times as long because of variables such as currents inside the jar, settling of carbon dioxide, etc.)
2. Using the same size candle, cover it with a pint jar. How does the burning time compare with the quart jar?
3. Have students estimate how long a birthday candle will burn (how many minutes) before going out. Record starting time and assign a candle monitor to be in charge of checking the candle periodically. The monitor will determine the time that the flame was extinguished. While the candle is burning have the students compute and record the time that it will be if their estimation is exact. Example: If the candle is started at 9:56 and John predicts 19 minutes, it will be 10:15 when it is extinguished.

The Covered Candle

Materials:

Quart jar
Birthday Candle - 5½ cm, 2⅛"
Matches
Stopwatch or clock with a second hand

Procedure:

1. Place the candle on the table and light it. (anchor it in clay or melted wax)
2. Cover the burning candle with the jar or glass.
3. Check the second hand on the watch for time.
4. Observe.

Questions:

1. What was in the jar when it was placed over the burning candle?
2. What happened after the jar was placed over the burning candle? Why did it happen?
3. What would the results be if a larger jar had been used to cover the candle?
4. What do you think the results would have been if a shorter candle had been used?

5. What does this experiment prove?

Caution: This experiment should be done with adult supervision.

Gummy Bears

I. Topic Area:

Number Concepts and Graphing

II. Introductory Statement

Students will use gummy bears to count, classify, and construct a graph.

III.

Math Skills	Science Processes
Estimating	Observing
Counting	Classifying
Comparing	Recording data
Computation	Communicating
Graphing	Using knowledge to solve problems
Problem solving	

IV. Materials

Assortment of Gummy Bears randomly portioned into small Ziploc baggies—approximately 10-15 per baggie.

V. Key Question

How many gummy bears are in your baggie?

VI. Background Information

Gummy Bears may be purchased by the pound (bulk) or by the bag. Randomly select a number of Gummy Bears for each baggie making sure the number is appropriate for the grade level. (10-12 for very primary grades—more for others.)

VII. Management Suggestions

In making comparisons of sets of bears, the teacher may ask appropriate questions, but also allow time for students to observe and share comparisons of their own.

VIII. Procedure

1. Distribute a small baggie of Gummy Bears to each small group of students.
2. Have students estimate how many bears are in a baggie.
3. Record estimates on chalkboard or overhead. Ask questions about the estimates listed. Do you see your age? Can you find a number that is the same as 4 + 3, 10 − 2, or 3 more than 9, etc.?
4. Sort bears according to color on sorting sheet.
5. Make a record of the number of bears on sorting sheet.
6. Build a real graph of bears by forming columns of bears in each color—placing one bear in each square. Which color has the most? the least?
7. Make a representational graph by coloring the pictures of the bears and placing a picture in each square as you remove each gummy bear.
8. In the large gummy bear pattern draw or write a number story about gummy bears. For example, three red gummy bears and four white gummy bears make seven gummy bears altogether.

IX. Discussion

Discussion will vary at the discretion of the teacher. Suggested ideas include: adding or subtracting the sets by color; comparing sets by using relationship signs (<, >, =).

X. Extension

1. Use gummy bears to make pattern strips where students observe and recognize the pattern and then complete or repeat it.

Name: ______________________________

Gummy Bears Tally

I had _____ yellow s.

I had _____ orange s.

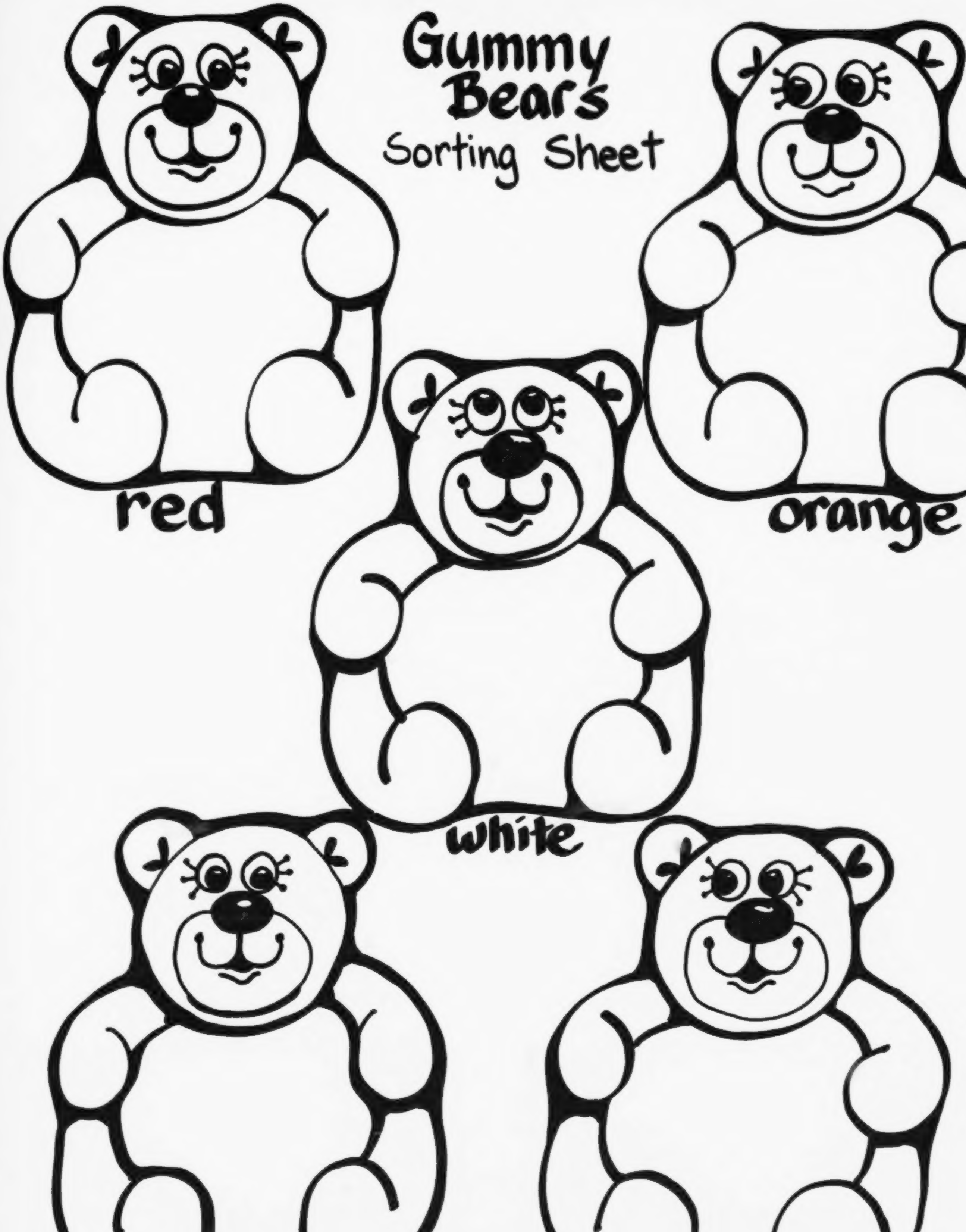
I had _____ red s.

I had _____ white s.

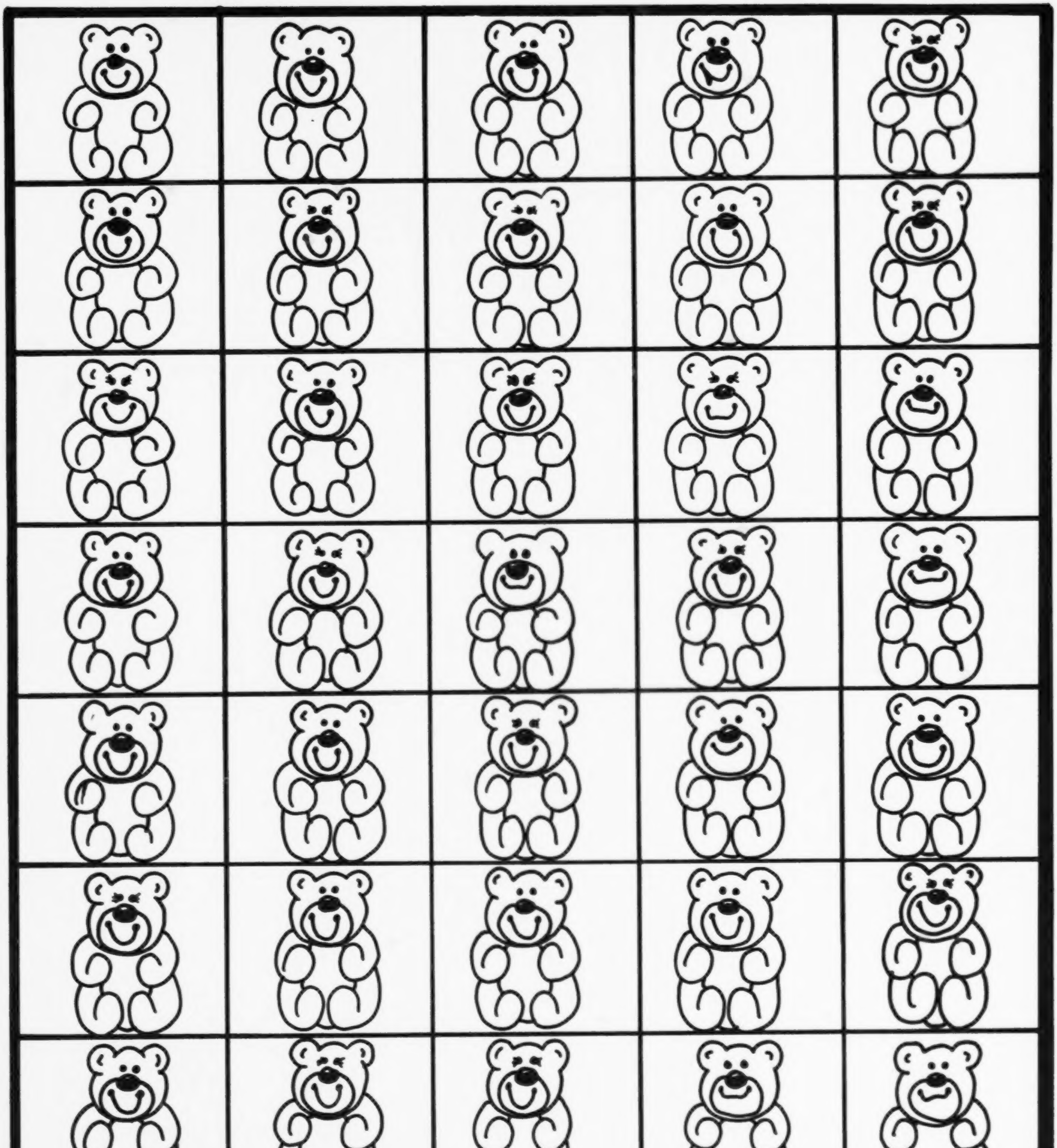
I had _____ green s.

I had _____ s in all.

Gummy Bears
Sorting Sheet



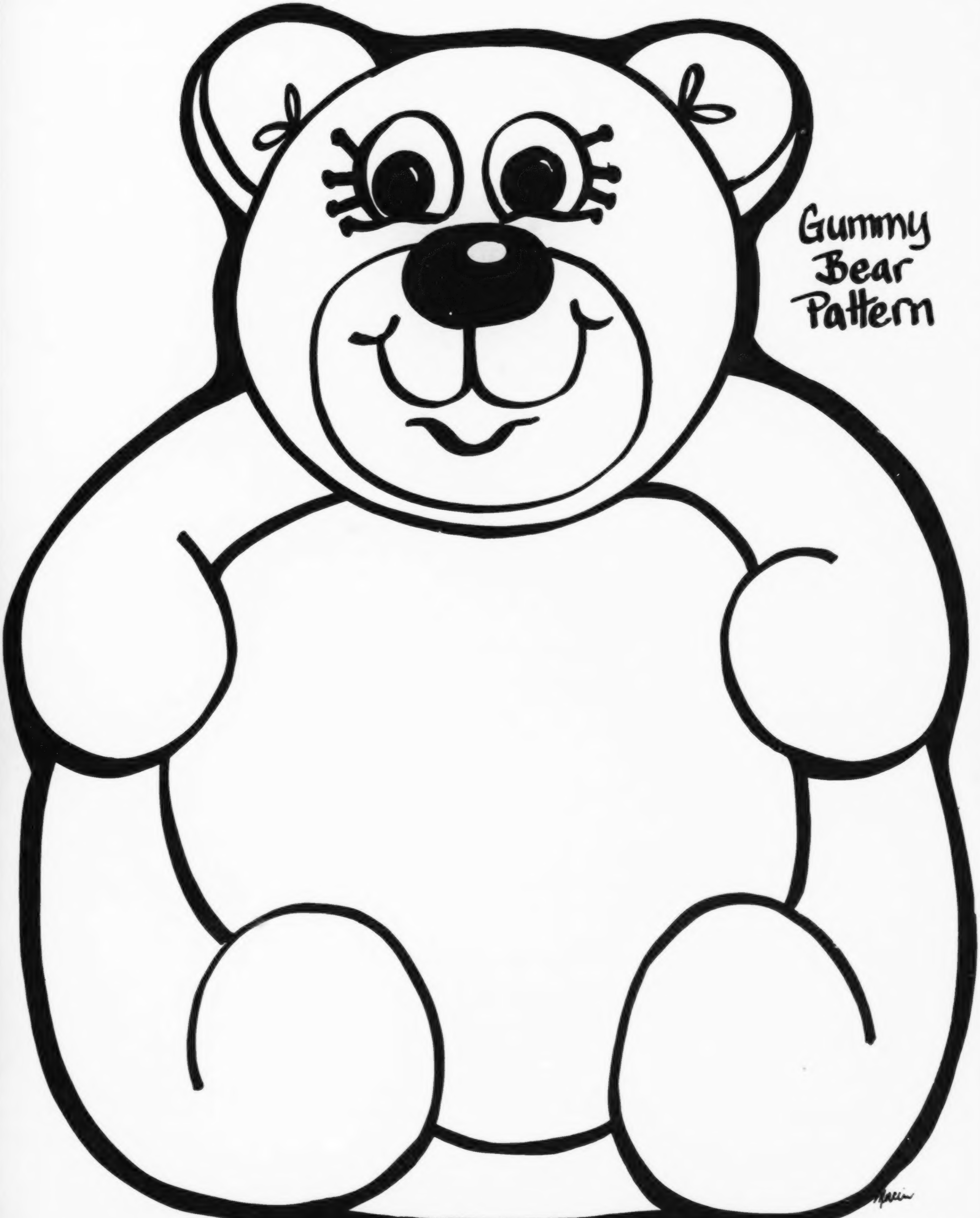
Name:



yellow	orange	red	white	green

Name:

yellow	orange	red	white	green


Gummy
Bear
Pattern

BEAR FACTS

I. Topic Area:
Measurement

II. Introductory Statement
Students will use stuffed bears to measure and compare.

III. Math Skills
Measuring
Comparing
Subtracting
Counting
Estimating

Science Processes
Observing
Measuring
Comparing
Collecting data
Recording data
Communicating

IV. Materials
Each student needs to bring a well-loved "bear" from home.

V. Key Question
How do you compare to your bear?

VII. Management Suggestions
1. Teachers may wish to have on hand an extra Teddy Bear for students who have no bear and wish to "adopt" for the day or you may wish to have students work in pairs and share a bear.
2. In preparation for measuring, students may color, cut out, and assemble the Bear Facts measuring tape.
3. Students need to work in partners to measure each other. This works nicely, too, if they are sharing a bear.

VIII. Procedure
1. Arrange ahead of time for a "bring your bear to school" day.
2. Prepare Bear Facts measuring tapes and become well acquainted with how to use them.
3. Record the bear's name and picture on the worksheet.
4. Use the measuring tape to measure and then record each student's height, length of arm, length of leg, and around the tummy. Then repeat the procedure for the bear.
5. Compare measurements by finding the differences.
6. How many bears tall are you?
7. Describe and record one way that your bear is special.
8. Compare yourself to your bear by drawing a picture of you and then of your bear.
9. Tell or write about 3 ways you are like your bear and 3 ways you are different from your bear.

X. Discussion
1. How much taller are you than your bear?
2. How many bears tall are you?
3. Which measurement—height, arm length, or around your belly—is closest to being the same as the bear?
4. What other ways can we compare ourselves to our bears? age? weight? eye color? food likes and dislikes? number of fingers and toes? length of smile?

XI. Extension
1. Arrange bears in a line or a train from small to tall or light to dark...etc.
2. Make a collection of Bear Facts for a class Big Booklet that tells about bears at school.
3. Take a Polaroid picture of students and their bears for scrapbook.
4. Choose one bear and measure each child's height in bears. Make a bear graph that shows each child's height in bears.

BEAR FACTS

OWNER ______________________

Bear's Name

Snapshot

How do you compare to your teddy bear?

Use a ruler or a tape measure to measure you and your bear. You may need a partner. Record your answers in the chart.

	Height	Arm Length	Leg Length	Around Belly
ME:	cm	cm	cm	cm
BEAR:	cm	cm	cm	cm
Difference:	cm	cm	cm	cm

Use your bear to measure you. How many bears tall are you? ______________ bears

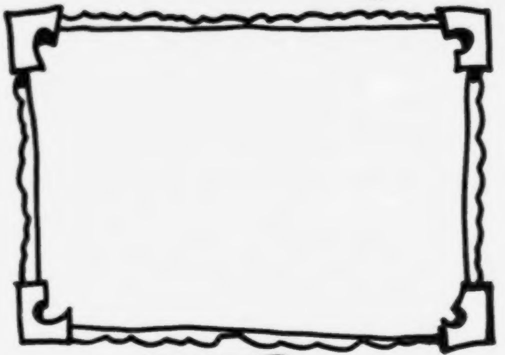
What makes your bear special? ______________________

____

____

BEAR FACTS

How do you compare to a bear?



ME

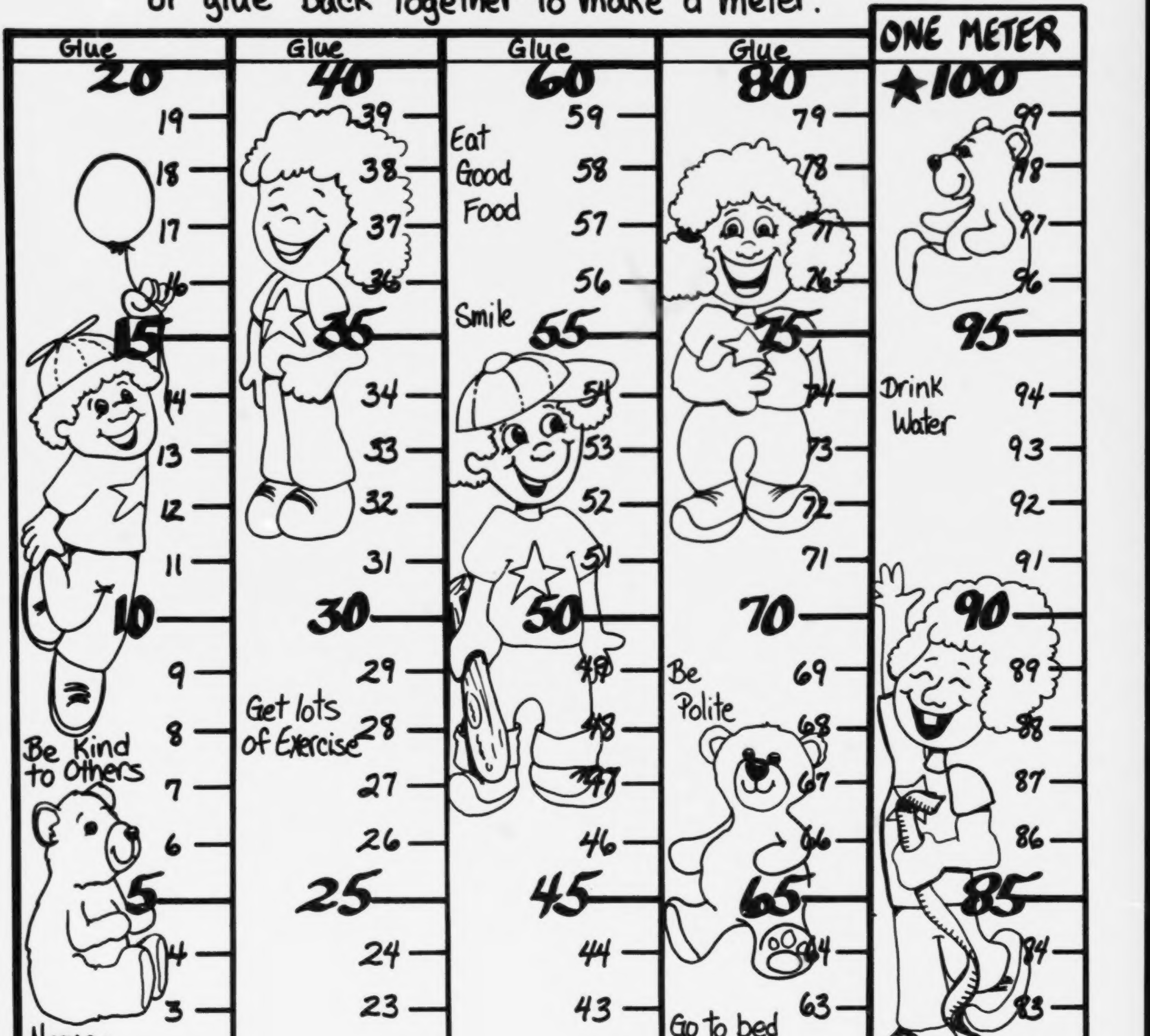
BEAR

How are you like a bear? ______________________________

How are you different from a bear? ______________________________

BEAR FACTS

Color, Cut out the Tape measure on the dark lines. Tape or glue back together to make a meter.



Consumer

Peanut Butter Crunch

Which brand is best?

I. Topic Area
Probability and Statistics

II. Introductory Statement
Advertisements constantly promote one brand of peanut butter as being the most nutritious, while another advertises that only "choosy" mothers pick their brand. Still another states that only theirs tastes like "fresh peanuts". In this investigation, students will do a comparative study of favorite brands, nutritional value, costs, and a taste preference test to determine the best brand of peanut butter.

III. Math Skills
Computing percentage
Use of calculators
Problem solving
Graphing

Science Skills
Predicting
Collecting and recording data
Comparing
Interpreting data
Applying and generalizing
Observing (tasting)

IV. Materials
6*paper plates
Plastic spoons/tongue depressors/or coffee stirrers
Small pieces of paper for survey
4 jars of peanut butter (18 oz. is best) of similar size and shape with labels covered (at least 3 leading brands and 1 house/generic brand)
*Jif, Skippy, Peter Pan, and Lady Lee are all similar size and shape.
**Optional—use a fifth brand, either homemade or from a health food store.
Colored pencils for graphs.

V. Key Question
How does your favorite peanut butter rate?

VI. Teacher Background
Students are easily influenced by what they see and hear on radio and TV. This investigation should lead them to listen more carefully to what is being said about certain products, and to examine labels carefully.

Students have difficulty computing percentage. They should have a full understanding of how to do this in order to complete this investigation.

$$\% = \frac{\text{number of students choosing a brand}}{\text{total number of students}}$$

Calculators may be used to compute the percentage. Students need to know how to convert a decimal to a percent.

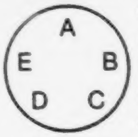
VII. Management Suggestions
This investigation takes approximately 2 class sessions. The teacher should keep the master tally of student preferences in the taste test. This will prevent one student from influencing the others. It may be helpful to have some crackers on hand during the taste test. It is also helpful to have something available to drink after the taste test.

VIII. Procedure
Students will be told that they will be doing a comparison study on 3 leading brands and 1 house/generic brand of peanut butter. If desired, a health food brand or homemade peanut butter may also be tested.

The students will rank the peanut butters according to their predictions and also the percent of their classmates that will choose the brands.

A class survey will be taken at this time. Small slips of paper will be passed out to each student who will then list their personal preference according to the brands being tested. Two students can tabulate the results on the blackboard. Percentages can then be computed.

The taste test will now be conducted. The jars, labels covered, and labeled A,B,C,D will be placed on display. Paper plates will be passed out (labeled A,B,C,D in circular form) to each student. The teacher herself, or responsible students will be assigned to give out samples of each kind. (The teacher may also decide to fix all the plates ahead of time if he/she has proper storage area.) Students will also be given a spoon or coffee stirrer for sampling. Students will then do the taste preference test and report their personal perference to the teacher, who is keeping the master tally.



After the tasting has been completed, the students will make their predictions as to what brands A,B, C,& D really are. Students at this time will also make their predictions as to the costs of each of the brands. (A note of caution here—if you are doing this experiment with several classes, it would be wise to switch labels on the jars, making B become C, etc.)

Upon completion of the tasting, tallies will be written on the board, and the percentages will be computed. Brand names will be revealed at this time along with the actual cost.

After the taste test, a chart can be drawn on the board, and 4 students picked randomly will fill in the information (nutritional) on the brands. Students will fill in their charts and make their judgments.

Students will then complete the statement on the bottom of the second page and go on to complete the triple bar graph on the third page. Students should have the option of designing their own graph or using the one given. Colored pencils may be used if available. (Younger age groups may elect to do one graph at a time as they complete each section.)

As a final activity, students will design an ad to sell the best peanut butter, using as much of the material as possible from the investigation.

IX. Discussion

What is the best brand?

Are there standards for peanut butter? What about the naturals?

What should be considered when buying this product?

Have your personal feelings changed about brands after completing the investigation? why?

Talk about the different sugars in peanut butter (molasses, dextrose, etc.).

X. Extended Activities

Do a cost variation on the brands (store-to-store) after the test.

Construct graphs to show nutritional value and costs.

Choose another product and run a similar test.

Do a survey on creamy-vs-crunchy peanut butter.

XI. Curriculum Coordinates

Social Studies—Use this during a unit on the South—plantations.

Language Arts—Write letters to companies on nutritive value of naturals.

Errata

Please note that the last statement in VIII Procedure of "Some Like It Salty" in the August Issue of the AIMS Newsletter should read: "If the egg is fresh, it will not float."

AIMS Education Foundation Processing Workshop Invitations

The AIMS Education Foundation is continuing to accept invitations to host one-week AIMS Workshops during the summer of 1987. Schools or school districts in any of the fifty states may apply to host the AIMS Workshops. Action is being taken on applications that have already been filed and announcements will be made as early as possible in future issues of the **Newsletter.**

Each workshop will be of five days duration and include 30 hours of instruction. The emphasis will be on the "hands-on" integrated mathematics/science activities drawn from the extensive AIMS resources, including materials to be developed in the 1986-87 writing programs.

Experienced workshop leaders drawn from the AIMS National Leadership Network will serve as instructors.

Host schools must provide appropriate classroom space and related services at no cost to the Foundation. The Foundation will pay for all instructional costs, the hosting of instructors, materials and supplies. The Foundation will also supply the needed equipment.

The minimum enrollment per section has been raised to 25 participants in order to serve as many teachers as possible. The maximum enrollment per section remains at 40. Pre-registration will determine whether the minimum enrollment is assured and will be used to limit each workshop section to the maximum. Schools and school districts may join efforts to assure the minimum enrollment. The Foundation will provide promotional literature upon request.

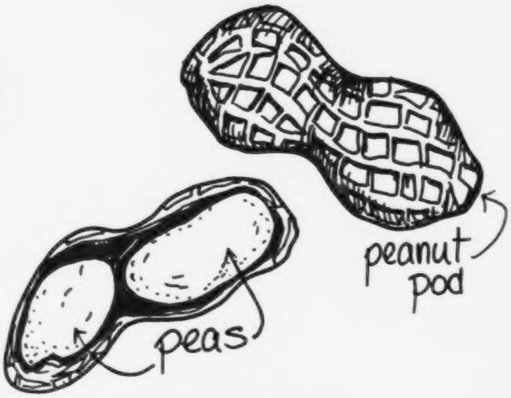
Each sponsoring school may choose from several formats: a single section workshop in which the entire range of K-9 materials is presented and explored; a two-section workshop in which instruction is focused on a K-3 strand and a grades 4-8 strand (minimum total enrollment is 50 participants); or a three-section workshop in which K-2, Grades 3-5, and Grades 6-9 strands are offered (minimum total enrollment is 75 participants). An instructor is provided for each strand.

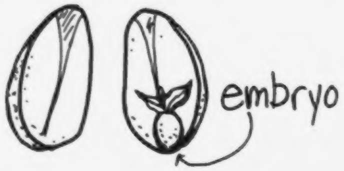
Participants will receive 30 hours of instruction, numerous handouts of AIMS materials with duplicating rights, and their choice of three Project AIMS publications. The basic cost without credit is $160. Two semester units of college credit is available for an additional $48 fee. College credit is optional.

Schools desiring to host AIMS workshops are encouraged to contact the AIMS Foundation promptly. Full details will be provided together with the formal application form. Address all correspondence to:

1987 AIMS Workshops
AIMS Education Foundation
Box 7766
Fresno, CA 93747

Peanut Facts





Scientific name: Family: Leguminosae
Genus: Arachis
Species: Hypogaea

Food Value:

Fat	47.5 %
Protein	26 %
Carbohydrates	18.6 %
Water	5.6 %
Other	2.3 %

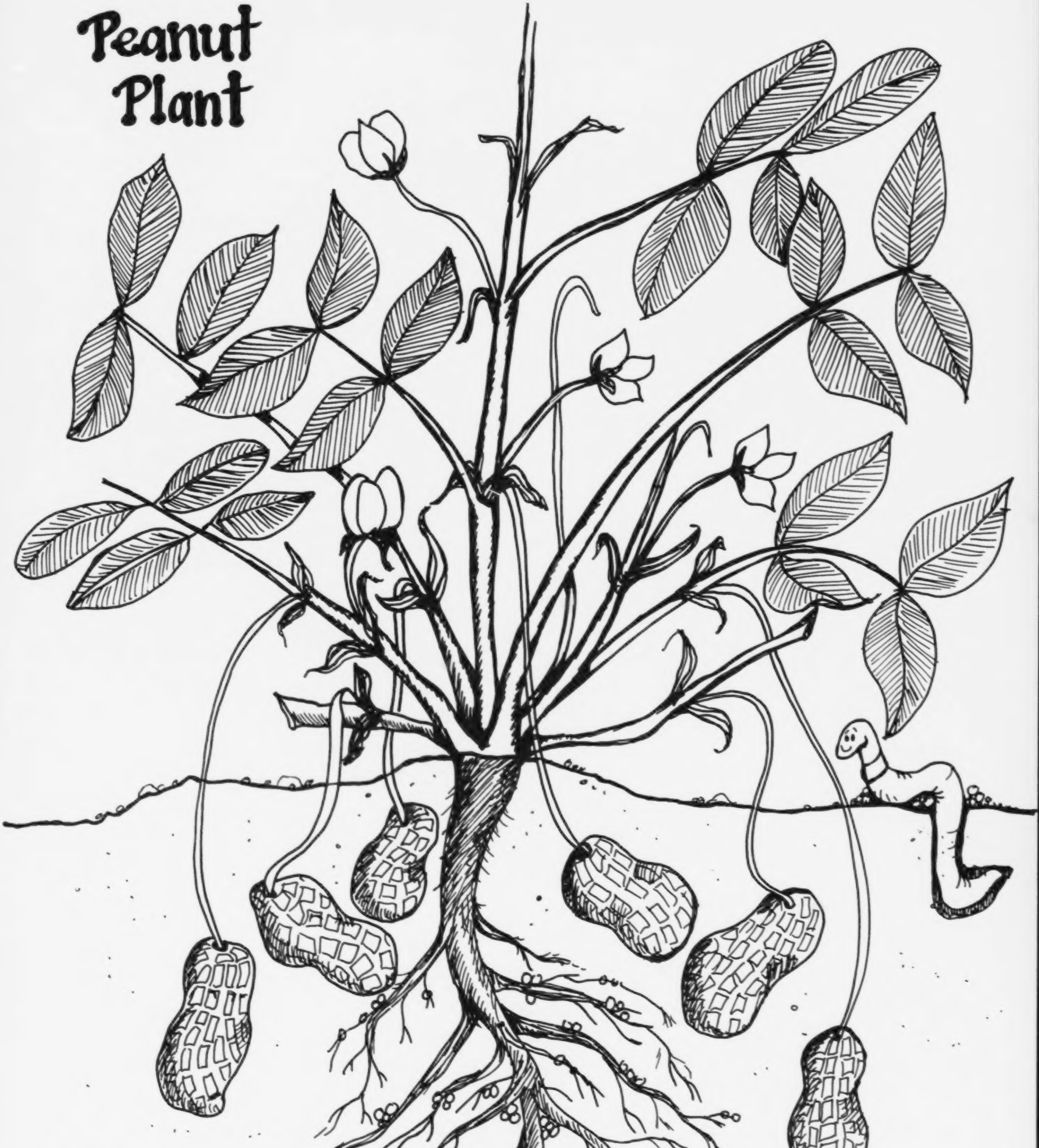
Peanuts are the fruit of the peanut plant. Although they look like and taste like nuts, they are really a kind of pea- a pea that grows underground. The spongy, dimpled peanut shells are actually pods that usually contain two peas, but can contain from one to five. Peanuts are often called groundnuts, but are also called goobers, goober peas, ground peas, and pindas.

Peanut plants are annuals that grow in warm sandy places. The vines grow to about 2 feet tall and 3-4 feet wide. Peanuts are usually planted in May and harvested in October. The plants have yellow flowers that blossom for 2 to 3 months. The flowers open at sunrise, are pollinated by noon, soon wither, and fall off. A green peg will emerge from the withered flower and it will grow downward into the soil to a depth of 1 to 3 inches. The tips of the pegs swell and mature into pods. When the plant begins to turn brown, it is time to harvest the peanuts. The entire plant is pulled out of the ground. The pods are allowed to dry and are then pulled off. Some pods are saved for planting next year's crop.

None of the peanut plant is wasted. The plant itself is used for livestock feed. One half of all peanuts is turned into peanutbutter. One fourth of all peanuts is roasted and salted for human consumption. Peanut oil is used in salad dressings, soaps, face powders, shaving creams, and shampoos. Even the shells are ground into powder and used in wallboards, plastics, and abrasives.

The next time that you eat a peanut, open up one of the small peas. It will usually split in half easily. On one side, there will be a tiny peanut plant, an embryo just waiting for the right conditions to grow.

Peanut Plant



____
Consumer

Peanut Butter Crunch

Which brand is best?

My favorite brand of peanut butter is __________.

I. Predict (in order) the favorite brands of your classmates from most favorite to least favorite. Estimate the percent of each choice.

Prediction:

Brand:					
Student#:	#	#	#	#	#
Percent:	%	%	%	%	%

II. Next, count the results of the class survey and compare to your predictions.

Results:

Brand:					
Student#:	#	#	#	#	#
Percent:	%	%	%	%	%

III. Now that you know the class favorite, let's take a "taste test" and check your results.

	Brand A	Brand B	Brand C	Brand D	Brand E
Brand:					
Student#:	#	#	#	#	#
Percent:	%	%	%	%	%

My favorite taste is __________.
The class favorite taste is __________.

61

____
Consumer

Peanut Butter Crunch

Which brand is best?

IV. Predict the cost and compare this to the actual price for each of the brands. (18 oz. jar)

Brand:					
Predicted Cost:					
Actual Cost:					

The best buy is: _______________

V. Finally, compare the nutritional value by checking the labels.

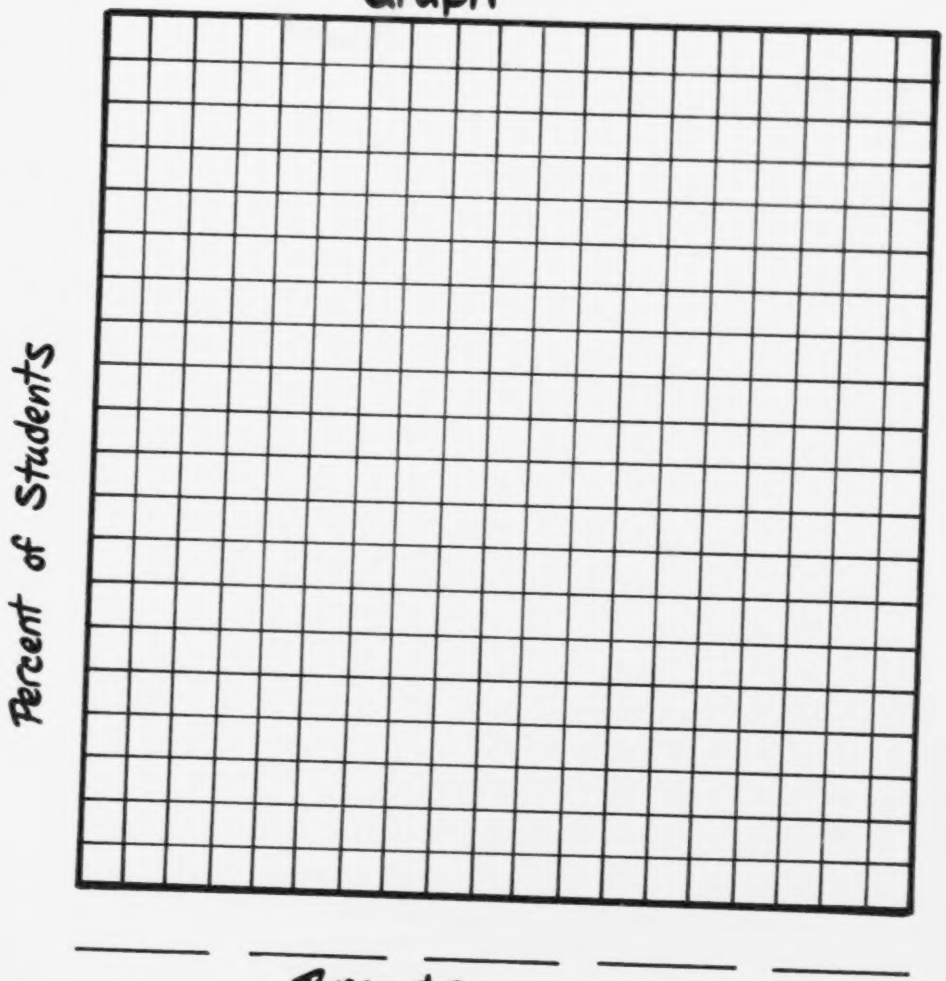
Brand Names:

Nutrient:					
Calories:					
Protein:					
Carbohydrates					
Fat:					
Cholesterol:					
Sodium:					

The best nutritionally is: _______________

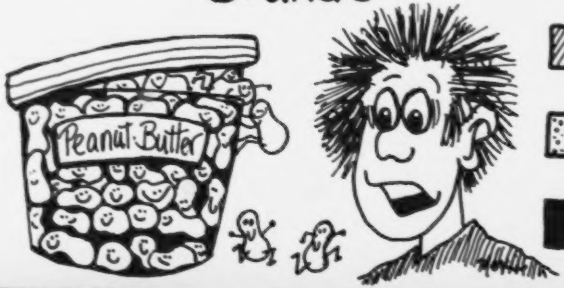
If I went to the store today, I would buy: _______________

Graph



______ ______ ______ ______ ______

Brands



▨ Prediction

░ Actual

■ "Taste Test"

______________ Consumer

Peanut Butter Crunch

VI. Complete the graph. Compare your predictions, the class survey, and the "taste test."

VII. Design an ad to promote your brand of peanut butter. Use facts "discovered" in the investigation of peanut butter brands.

My ad. . . .

The Golden Age of Exploration

Martin Suey

Columbus, Ponce de Leon, Pizarro, Coronado

Which great explorer/adventurer's footsteps would you like to retrace? Columbus, Cortez, all of the above? Then *The Seven Cities of Gold*, the great interactive simulation from Ozark Softscape and Electronic Arts, is the software to liven up your social studies program. *The Golden Age of Exploration* from SETUP is the book of classroom management suggestions, teacher and student materials that includes information on many of the major voyages of discovery, hands-on science activities, and much more. It was developed to help integrate *The Seven Cities of Gold* into the curriculum.

It's 1492. You've just had your audience with Queen Isabella at the Court of Spain and now it's up to you to make good your boasts of gold and treasure available for the taking in the New World. Your ships are riding the tide in the harbor. You've stocked each squat vessel with the men, food, and goods you think necessary for your voyage. It's time. You board your flagship, weigh anchor, set sail to catch the favorable westerly wind and begin your computer adventure.

The Seven Cities of Gold is an amazingly accurate simulation of the voyages of discovery to the New World. You sail your ships with an eye to the food and water needs of your crew, stopping off at landfalls, to replenish supplies, trade with or conquer the local natives, and search for gold. Over time you attempt to establish forts and then missions and, assuming you've survived, will either be rewarded or punished for your efforts. In Spain you update your maps by adding recent discoveries, buy more supplies and hire additional men, and prepare for your return to the New World. This is all provided and managed within the software itself.

The key to making this work in the classroom is found in the materials developed by Martin Suey for project SETUP. All the important historical voyages are outlined for teachers and students. The science activities include building and using simple paper devices for determining geographical north and therby your latitude (the early explorers could not determine longitude accurately), and determining the best hull design to maximize cargo carrying ability.

Outfit your classroom now and get ready to head west into the unknown.

"Out of this World" will be published in November, 1986 instead of October to make possible an expanded version.

ROBOT'S ODYSSEY I

SETUP's **Robot Odyssey** I materials provide teacher and student reference materials to successfully engage students in building electronic robots which in turn serve various functions in solving problems posed at each of the five levels. Student materials offer suggestions on procedures as well as helpful hints. Teacher materials include suggested class procedures, classroom environment suggestions, solutions for each problem, maps for the five mazes, extensions involving logic gates and circuits, and binary adders. This program, supported by these materials, provides abundant challenging problem-solving activities that will enrich the experiences of the best students. Grades 5-12.

SLEUTHING ACROSS AMERICA

Sleuthing Across America provides teacher and student support materials for **Agent USA**, a software program from Scholastic, Inc., in which students travel around the United States via a simulated train network in order to catch a menacing FuzzBomb. U.S. geography, math, and problem solving skills are enhanced. Students will collect information, make and test hypotheses, and develop strategies while trying to solve the case. Included are suggestions for guiding the class through the problem solving experience, preliminary activities on time zones, and the location of U.S. cities, forms for recording information gathered while using the software, extended activities, and answer keys. Grades 5-8.

ROCKY'S CIRCUITS

Rocky's Circuits provides teacher and student support materials for **Rocky's Boots**, the award-winning logic problem-solving program from The Learning Company. **Rocky's Circuits** takes the learner through the hands-on construction of the "logic gates" used in **Rocky's Boots**, using low cost and readily available materials; provides essential background information to the teachers, and offers numerous extension ideas to follow-up the learner's software experience. The electric circuits, powered by flashlight batteries, are clearly laid out and precisely duplicate the function of the logic gates. Grades 5-12.

Project AIMS

BOOKS AVAILABLE

Grades 5-9 Series:

Book 1—**Math + Science, A Solution,** consists of twenty-five investigations taken from all subject matter areas.

Book 2—**The Sky's the Limit,** contains twenty-four investigations dealing with flying objects from paper airplanes to water rockets.

Book 3—**From Head to Toe** includes studies of the human body including functions and response of lungs and heart to various conditions plus skeletal structure.

Book 4—**Fun With Foods,** A Recipe for Math and Science contains a series of investigations utilizing and analyzing common foods.

Book 5—**Floaters and Sinkers** contains studies of objects that float or sink under a variety of conditions and the reason why. Excellent for junior high school.

Book 6—**Down to Earth** contains studies in earth science including a final comprehensive unit dealing with prospecting to find the composition of a hill built by students.

Book 7—**Our Wonderful World** includes studies dealing with the environment, utilizing readily accessible materials.

Book 8—**Pieces and Patterns, A Patchwork In Math and Science** is a fascinating collection of a variety of activities from Shadows and Sundials to Kaleidoscopes and Turtles.

Book 9—**Out of This World** (see page 25 for description). Publication date: November, 1986.

Bk. 10—**Probably So!** (see page 25 for description). Publication date: December, 1986

Grades K-4 Series:

K-1 **Fall Into Math and Science** (Book 1) is a collection of experiences that relates to the fall season of the year and its holidays...from Apples-A-Peel to Me to Spinning Ghosts.

K-1 **Glide Into Winter With Math and Science** (Book 2) includes activities that reflect the joy and wonder of winter and its holidays including Christmas and a life size Gingerbread Boy.

K-1 **Spring Into Math and Science** (Book 3) contains "spring-like" experiences and includes everything from bunnies and eggs to rainbows and leprechauns.

2 **Seasoning Math and Science** (Book A) contains studies that deal with Fall and Winter and related holidays from seeds and beans to batteries and bird's nests.

SPRING INTO MATH and SCIENCE
Overhead and Underfoot
FALL INTO MATH and SCIENCE
HARDHATTING IN A GEO-WORLD
JAW BREAKERS AND HEART THUMPERS

2 **Seasoning Math and Science** (Book B) rounds out the study of the seasons with the addition of Spring and Summer activities for second graders.

3-4 **Jaw Breakers and Heart Thumpers** (Book A) combines the study of fun foods and body basics in such activities as Gimme Five and By Golly, By Gum.

3-4 **Hardhatting In a Geo-World** (Book B) explores the mysteries surrounding skyscrapers, bridges, one-sided paper and bubble planes through the study of structures and design.

3-4 **Popping With Power** (Book C) contains activities that deal with energy sources and conservation from Save-A-Watt to Polar Brrs...

3-4 **Overhead and Underfoot** (Book D) is full of weather and natural environment studies that give students experience with cloud formations, relative humidity, rainfall and shadows.

ORDER INFORMATION

Send all orders and remittances to:
AIMS Education Foundation
P.O. Box 7766 · Fresno, California 93747

The following are currently available:
Please order by book number and title.
Correlations to the California Science Framework Addendum for grades K through 9 are available for $9.

Grades 5-9 Series:

Book 1—Math•Science, A Solution	$10.95
Book 2—The Sky's the Limit	10.95
Book 3—From Head to Toe	10.95
Book 4—Fun With Foods	10.95
Book 5—Floaters and Sinkers	10.95
Book 6—Down to Earth	10.95
Book 7—Our Wonderful World	10.95
Book 8—Pieces & Patterns, Patchwk in Math & Sci	10.95
Book 9—Out of This World	10.95
Book 10-Probably So!	15.95

NOTICE:
—All California orders must add 6% sales tax.
—All orders will be charged a 10% shipping-handling fee.
—Schools may use purchase orders.
—Each book consists of Student and Teachers's Manual.

Grades K-4 Series:

K-1	Fall Into Math and Science, Bk. 1	$10.95
K-1	Glide Into Winter w/Math & Sci., Bk. 2	10.95
K-1	Spring Into Math and Science, Bk. 3	10.95
2	Seasoning Math & Sci.(Fall & Winter)	10.95
2	Seasoning Math & Sci.(Spr.-Summer)	10.95
3-4	Jaw Breakers and Heart Thumpers	10.95
3-4	Hardhatting in a Geo-World	10.95
3-4	Popping With Power	10.95
3-4	Overhead and Underfoot	10.95

Note: purchase of books entitles school to make 200 copies of student manual pages for classroom use.

Science Poster Series:

Set A	$10.95
Set B	10.95
Set C	10.95
Set D	10.95
Set E	10.95
Set F	10.95

Mathematics Posters Series:

Set A	$10.95
Set B (Available October, 1986)	10.95
Set C (Available October, 1986)	10.95
Set D (Available November, 1986)	10.95
Set E (Available November, 1986)	10.95
Set F (Available September, 1986)	10.95

Project SETUP Books:

Rocky's Circuits	$10.95
The Golden Age of Exploration	10.95
Robot's Odyssey I	10.95
Sleuthing Across America	10.95

What Teachers Say...

About the 1986 Science Festival

(Ed.Note: "What Teachers Say..." will be a regular feature of the AIMS Newsletter through which we will share comments teachers make about various AIMS and AIMS related activities. This month's comments are from the evaluations of the 1986 Science Festival at Fresno Pacific College, Fresno, California. Visiting science faculty included Verne Rockcastle, Gilbert Yee, Del Alberti, Joe Abruscato, Herb Strongin, and Al Guenther. Resident science faculty included Judith Hillen and Arthur Wiebe.)

"This Festival was beyond my wildest dreams. As a teacher with very little science background, I found myself able to understand concepts I had never understood before." D.P.

"I really enjoyed the past two weeks! The instructors were dedicated, extremely knowledgeable, and professional. I also learned from fellow students." T.I.

"Fantastic! We learned a lot of science through the same means I think we should be teaching our students. There was also excellent instruction on the integration with the rest of the curriculum. Thanks for an exciting, valuable experience." K.F.

"I feel I will be a better science teacher because my total outlook has been altered here. I've definitely moved up a level in understanding and approach." P.G.

"This has been, without doubt, the most valuable experience of my 20-year educational career. It has helped me bring into focus many things that I have been trying to do for years and have not been quite able to achieve. It has also given me the teaching strategies and activities to accomplish my goals as a teacher." D.N.

"What an excellent program. I can't wait to introduce it to my students and fellow teachers." A.M.

"I learned more science in two weeks than I ever learned in my multitude of years in school. Terrific!" N.Q.

"I enjoyed the opportunity to get to know these people who are excited about what they do and to learn more about how they developed themselves, as well as learning how to draw forth students' understanding of concepts and processes through their own experiences." H.G.

"All of the great ideas, techniques, and styles have been wonderful! Thanks for the opportunity. Fantastic way to become "charged up" for next year's activities. I hope to be able to return again." S.S.

"Very practical, but also very good instruction as to the philosophical reasons for the activities." R.R.

"Well organized, good facilities, talented and superior instruction, relevent materials, concepts, and curriculum. Tons of handouts." J.K.

"The content and guest speakers were truly outstanding! The Project AIMS activities were new and given at all grade levels. The whole festival was well-planned and I loved it!!! Thank you! I got tons of ideas." K.M.

"Outstanding! Almost too much in two weeks. So glad to see the "process" orientation for all classes. Lectures amusing, informed, energetic, patient, helpful...terrific teachers." U.K.

"I have never attended anything of this sort. Thank you, very much. Very well organized. Your instructors were of high caliber and what made it successful was the excitement of these instructors and its effect on the atmosphere. Great job!"

"The first time I hated being sick and missing a session! Teachers were fantastic! Materials could be used at any level, thanks to teachers explaining how to use it at that level." M.G.

"I'm ready to go back to my class enthusiastic about teaching science and math and also excited that I can share this background with my fellow teachers." B.G.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

BULK RATE
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

67

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation

Volume I, Number 3 October, 1986 © AIMS Education Foundation

1987 Festival of Mathematics Expanded

The program for the 1987 Festival of Mathematics has been expanded to nine strands to better serve the participants, according to an announcement by Mr. Lawrence Ecklund, Director of the Fresno Pacific Math/Science Project. The sixteenth annual Festival of Mathematics is scheduled for June 22 to July 3 on the Fresno Pacific College campus.

The total capacity will be expanded by the nine-section program. The maximum enrollment in each will be reduced from 50 to 40 participants.

The K–1 section will be divided into two sections. Valerie Welk, returning for the fourth year, will teach the session for Kindergarten teachers. First grade teachers will have Kay Fletcher of Huntington Beach as instructor.

The former Grades 2–3 section will also be divided along grade level lines. Fran Threewit of Santa Rosa will serve as the instructor for Grade 2 teachers and Lawrence Ecklund will teach the Grade 3 section. Mr. Ecklund has been associated with the Festival from its inception in 1972.

Returning to teach the Grades 4–5 sessions is Dr. Jonathan Knaupp of Arizona State University. Judith Hillen of the Fresno Pacific College faculty and co-director of Project AIMS will return as the instructor for Grades 5–6.

Dr. Arthur Wiebe will instruct junior high school and general mathematics teachers, spanning grades 7–9.

The format for the high school teachers has been revised to provide for two strands and an integrated computer session. Teachers may select one of the two strands and participate in the study of computer applications to the mathematics curriculum. Fr. Stanley Bezuszka of Boston College and the Boston College Mathematics Project is returning by popular demand. His contribution to the 1986 Festival was widely acclaimed. In addition to teaching one strand, he will be the general session speaker for teachers in grades 7–12. Teaching the second strand will be Wilbert Reimer of the Fresno Pacific College faculty. Mr. Reimer has studied extensively under Dr. George Polya and the presentations in these sessions will be strongly impacted by that experience.

Mr. Jim Wilson will coordinate the integration of computer applications with the specific content of the junior and senior high school sessions. All of the instructors will cooperate in this effort.

Returning for her fourteenth appearance is Dr. Lola May of Winnetka, Illinois. She will continue to contribute her highly valued presentations as the general session speaker for teachers in grades K–6.

Information about the Festival and application forms may be obtained by writing: Fresno Pacific Math/Science Project, Frenso Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702.

1987 Summer AIMS Workshops Scheduled

In response to widespread and growing demand, the AIMS Education Foundation is offering an expanded program for the summer of 1987. The six AIMS Workshops offered during the summer of 1986 attracted more registrations than could be accommodated even though the capacity of each was enlarged considerably.

The one-week, 1987 AIMS Workshops for graduate credit will be offered on the Fresno Pacific College campus where the full resources of the program will be available. A May 11–15 Workshop has been scheduled specially to serve teachers in year-round schools. The other workshop dates are: June 15–19, July 6–10, July 13–17, and August 3–7.

The fee, including tuition for two semester units of graduate credit and all materials, is $210. Housing and meals are available at very reasonable rates. All facilities are air-conditioned.

In addition to the on-campus programs, the AIMS Education Foundation has begun scheduling one-week, off-campus workshops in selected parts of California and other states. As announced in the August issue of the AIMS Newsletter, invitations for hosting such workshops are being accepted from school districts and other educational agencies. Each workshop will be of five days duration and include 30 hours of instruction. The emphasis will be on the "hands-on" integrated mathematics/science activities drawn from the extensive AIMS resources, including new materials being developed by the current writing teams. Experienced workshop leaders drawn from the AIMS National Leadership Network will serve as the instructors. Host schools must provide appropriate classroom space and related services at no cost to the Foundation. The Foundation will pay for all instructional costs, the hosting of instructors, materials, and supplies. The basic cost without credit is $160. Two semester units of in-service credit is available for an additional $48. Included in the cost are the materials which, in addition to numerous handouts, include the choice of any three of the Project AIMS publications.

Applications from two school districts have been approved and AIMS Workshops scheduled: El Monte City School District and Ventura Unified School District, both in California. Both will feature three-section workshops at grades K–2, 3–5, and 6–8. Further information may be obtained from the AIMS Education Foundation. For information about the on-campus program write to the Fresno Pacific Math/Science Project, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, California, 93702.

Districts planning to host such workshops should submit an application as early as possible to be assured consideration.

AIMS
National Leadership Network Introduces Sheldon Erickson

Sheldon is a veteran member of Project AIMS having been among the original 75 teachers who initiated AIMS under a National Science Foundation grant in 1981 at Fresno Pacific College. Creativity and innovation are an integral part of Sheldon's life and teaching. He is currently in his fourth year teaching at Computech School in Fresno. He is a mentor teacher and teaches math to seventh and eighth graders. He has developed a new elective for his students called Engineering Concepts in which he introduces these young people to mechanical, structural, electrical engineering and surveying through the use of robots, Legos, and computers. They have already surveyed a lake and are now preparing to build a room sized geo-desic dome, and design cars and determine the drag coefficient in a wind tunnel. He feels very strongly that junior high students are not yet good abstract thinkers and therefore, the hands-on approach of AIMS is very appropriate and highly motivating. He says, "They may know how to manipulate numbers, but they don't know where they came from or how to apply them." Sheldon also finds time to serve as the Activity Director, Ski Club Leader and wrestling coach.

Sheldon has been adjunct faculty for Fresno Pacific College for the past four years serving the AIMS project as writer, facilitator, and workshop leader. He earned his undergraduate degree in Elementary Education with a minor in math and science from Trinity College in Illinois. He earned his Master's Degree from Fresno Pacific College and has initiated plans to earn his Doctorate from University of Southern California.

Sheldon has twice been a semi-finalist for the Presidential Award for Outstanding Teaching in Math and Science. We are surely proud to have Sheldon as part of our team!!! He serves as an excellent model for teachers and students.

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209) 291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California 93727. Volume I, No. 3.

EDITORS . . . . Arthur Wiebe, Judith Hillen
STAFF ARTIST . . . . Sheryl Mercier
OFFICE MANAGER . . . . Sheryl Bishop
PROGRAM DIRECTORS:
Fresno Pacific College Math/Science Project . . . . Lawrence E. Ecklund
AIMS Education Foundation . . . . Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes . . . Ted Ostrander
Project AIMS . . . . Judith Hillen, Arthur Wiebe
Project SETUP . . . . Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION
PRESIDENT . . . . Arthur Wiebe, Ed.D.
VICE-PRESIDENT . . . . Wilbert Reimer
SECRETARY . . . . Lawrence Ecklund
TREASURER . . . . Jon Hillen
ACCOUNTANT . . . . Robert J. Dwyer
STAFF ARTIST . . . . Sheryl Mercier

• THIS ISSUE • THIS ISSUE • IN SUMMARY • THIS ISSUE • THIS ISSUE •

The on-campus (Fresno Pacific College) and the first two off-campus AIMS Workshops for the summer of 1987 have been scheduled. The El Monte AIMS Workshop will be held in August, the exact dates to be announced. The Ventura AIMS Workshop is scheduled for July 13–17. **Story on Page 1.**

Introducing Sheldon Ericksen

Sheldon Ericksen has been involved with Project AIMS from its inception. **Story on opposite page.**

Tulare City Schools Implement AIMS Program

Under the leadership of Jim Wilson, the Tulare City Schools are using an effective model of implementing AIMS in their science program. Jim Wilson has been involved in Project AIMS since its inception, has served both as writer and facilitator, and is a director of Project SETUP. **Story on Pages 4 and 5.**

A Model of Mathematics, Continued

This second in the series on the Model of Mathematics developed by Dr. Arthur Wiebe focuses on movements among the forms of mathematics. **Article on Pages 6–8.**

Your Students Can Be Problem Solvers, Continued

This is the third and concluding article in the series with this title. Wilbert Reimer, a student of Dr. George Polya discusses the special role of square numbers, triangular numbers and powers of two. **Article on Pages 8–9.**

A Banquet At Tony's

This month's mathematics poster is one that features a problem which students in grades 5+ should be able to generalize. It is taken from Set A in the Mathematics Poster Series. **Page 10.**

The Magic Circle!

This hands-on paper-folding activity contains a wealth of geometry! It permits students to learn by hearing, seeing and doing in contrast to the common abstract approach. **Article on Pages 11–13.**

Balancing Forks

This month's science poster, **Balancing Forks,** is sure to astound some of your students! Since it involves matches, this investigation should be done under adult supervision. **Pages 14–15.**

Three New AIMS Activities

The first, for K–5, is entitled **The Jar That Likes to Keep You Guessing.** It stresses the all important skill of making a good guess or estimate. The sequence of activities span K–5. **Pages 16–20. BBs In The Jar** provides another investigation in which students make a guess and then check that guess. The first variation on Page 22 is a structured approach. The second on Page 23 is unstructured and students have to determine the method by which they will check the guess. A considerable number of the new AIMS investigations will come in both forms to give teachers the choice of which to use with which students. **Pages 21–23. Can You Planet** and **Planetary Facts** are from the forthcoming book on the solar system entitled **Out of This World!** scheduled for release in late November or early December. The book will feature an outstanding series of investigations and activities relating to the solar system. **Page 24.**

Sleuthing Across America

This is the third in a series on Project SETUP publication. It provides the classroom activities and lesson support for Scholastic's outstanding software program entitled Agent USA. **Page 30.**

What Teachers Say

Some of the 260 teachers from across the nation who attended the 1986 Festival of Mathematics at Fresno Pacific College comment on their experience. **Page 32.**

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ______________________

Address: ______________________

Street City

____

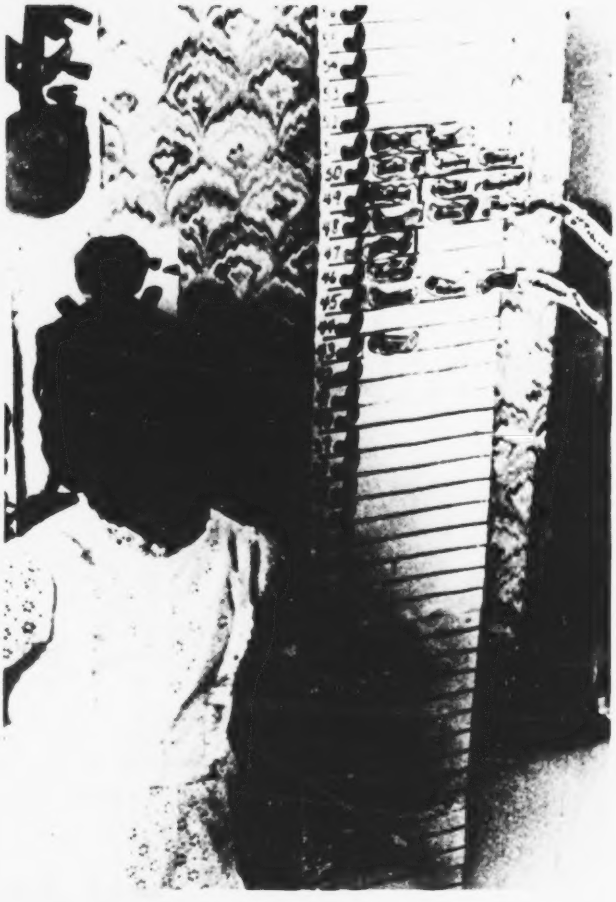
State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747

"Through dissecting the frog and studying its structure, students better understand the human body," Mike Wood, instructor of these students notes. Several AIMS investigations preceeded this activity.

Tulare City Schools Implement AIMS Program

Jim Wilson



The 1978 State of California Science Framework established the science process skills as being equally as important as science content knowledge in elementary science education.

Project AIMS was established to develop the materials needed to support this shift in emphasis and five Tulare teachers were members of the first AIMS writing team. These teachers formed the nucleus of in-district support so vital to the task of spreading the AIMS philosophy and materials. As the early AIMS activities were developed they were field tested in Tulare classrooms. The early successes of these materials when used with other interested teachers soon led to a cadre of teacher support at every school site.

Paralleling this early classroom experimentation was the interest and support of principals. As they observed AIMS in these classrooms they saw a new level of excitement in science instruction flowing from materials and methods compatible to the needs of teachers and students.

Right: "Am I Your Type?" By taking blood samples and determing blood types, students become familiar with this essential information.

Left, below: "Did you know that I am on this graph? How could you find my name?" Students relate to graphs about themselves and can chart their own growth during the year.

During the 1983-84 school year the available AIMS books were separated and the activities distributed into grade level books, Kindergarten through Eighth Grade. Every teacher in the district had the opportunity to review their grade-level book. Teacher suggestions were then used to finalize the content for printing under the terms of the site license agreement. (Information about site licensing is available from the AIMS Education Foundation.)

Concurrently, a 5-year AIMS implementation plan was developed. This plan provides teachers with all the materials (M & M's, etc.) and inservice training necessary to support the regular classroom use of AIMS. The 1984-85 school year is considered the first implementation year.

By the end of the 1988-89 school year, the district's goal is to have all K-6 teachers regularly using AIMS to provide science process skill development and mathematics integration to their students. The intervening years will be used to develop and/or acquire science content materials. As new AIMS books are written, their activities will be incorporated into the grade level books.

The junior high school program has been a laboratory, hands-on program for the past twelve years. Each student receives a full year of science instruction during both the seventh and eighth grade years. AIMS is used to supplement the junior high school science program.

Historically, no other district-wide curriculum effort has been as well received by administrators, teachers, and most importantly, students, as AIMS. The active learning principle of AIMS was used as a focus for a two and one-half day inservice program attended by over 200 district teachers prior to the opening of school. The success of AIMS in science has created a questioning among many district staff as to how other curricular areas can be improved.

Tulare City Schools will continue to support teacher participation in the summer math/science programs offered at Fresno Pacific College, membership on current AIMS writing teams, and the Trainers of Teachers Program.

A Table of Contents listing each AIMS activity by name and grade level assignment is available upon request from: Tulare City Schools, ATT: Pam Sotelo, 600 North Cherry Street, Tulare, California 93274.

Jim Wilson is the Mathematics/Science/Computer Education Specialist of the Tulare City Schools, Tulare, California.

A Model of Mathematics

Dr. Arthur J. Wiebe

(Ed. Note: This is the second in a series on the Model of Mathematics.)

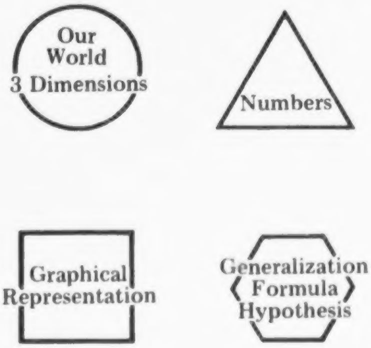
So far we have examined the **content** of mathematics by the use of the Model of Mathematics. In the Model,

the circle represents our three-dimensional world;

the triangle signifies the numbers we use to describe something within that world;

the square denotes the graphical representation or description; and

the hexagon represents a generalization, often in the form of a hypothesis or formula.



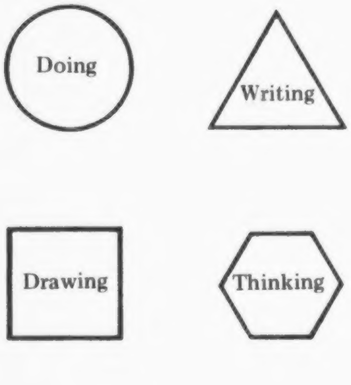
From the viewpoint of the **child's experience,**

the circle represents **doing** *something with objects;*

the triangle means **writing** *down numbers, operations, and relations;*

the square means **drawing** *a graph or other illustration; and*

the hexagon represents **thinking,** *finding a rule, and generalizing.*



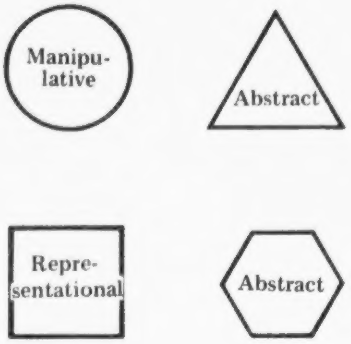
We can look at the Model from a third viewpoint: **the learning theory as espoused by Piaget.** From this vantage point

the circle represents the **manipulative** *level;*

the triangle represents one form of the **abstract** *level;*

the square denotes the **representational** *level; and,*

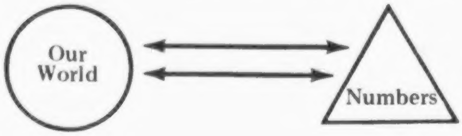
the hexagon represents a higher form of the **abstract** *level.*



This versatility of usage makes it clear that the Model can serve us well in many ways.

Next we turn our attention to the movement among the four forms. It is this movement which leads to a study of mathematics that is quite different from that which students typically experience. Such movement makes mathematics live, creates interest and meaning, and helps students to understand the interrelationship of mathematical concepts.

There are two and only two ways of moving from the circle to the triangle: counting and measuring.



Counting always results in whole numbers such as 5, 19, and 2,357. If done accurately, the result can be exact. It can be as simple as counting the number of students in the class; or as complex as finding the number of BBs in a pint jar. All of the results are elements of the counting number set.

On the other hand, **measuring is never exact!** Measuring results in messy numbers such as 2.38 centimeters plus or minus a thousandth of a millimeter. Regardless of how accurately we measure, the result is always **approximate.** We would serve our students well if this distinction between counted numbers and numbers resulting from measurements would be clearly understood and emphasized. It is important for us to constantly help students understand the difference between these two types of numbers and how they must be reported. In the real world measured numbers must of practical necessity be associated with the statement of how accurately the object was measured. So it should be in our classrooms.

When students work with these two types of numbers in the abstract, this understanding should influence the way they think of and operate on numbers. Measured numbers should always raise the question: **how accurately was the measurement made?** This is done by specifying the degree of accuracy used. Such information makes a major difference. If we say that something is 15 meters long, we cannot understand the meaning until we know whether it was measured to the nearest 5 meters, nearest meter, or nearest centimeter. For example, if measured to the nearest 15 meters it could be as short as 12.5 meters or as long as 17.49 meters. If measured to the nearest centimeter the range is reduced to 14.955–15.0049 meters.

The Model shows that these two paths can be followed in either direction. We can count or measure and record the result in a table, moving from the circle to the triangle, from three dimensions to two; or, we can look at numbers in a chart or table and use them or operate with objects in the real world, from the triangle to the circle. For example, a clerk can determine the amount of change to be given a customer by computing at the abstract level represented by the triangle and complete the transaction as a real world or circle activity by counting out the change to the customer. Traveling from the circle to the triangle indicates that we have abstracted a number from the real world; going in the opposite direction means that we take an abstract number concept and translate it into the real world through some action on objects.

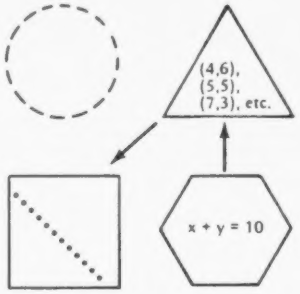
The early mathematical experiences of children should be at the manipulative level, in the circle representing our three-dimensional world. The following is an excellent working hypothesis: **children in the early grades should rarely lift up a pencil in a mathematics class ...except to make a record of something they have done.** Mathematics learned in this way will be rich in meaning and better remembered. It erases the question, "Why do we have to learn this?" Conversely, students in the middle and upper grades, where most of the work is at the abstract level, **should be able to translate that which they have done at the abstract level into a real world activity.** The tie between the real world and its abstract notation must be firmly implanted at all levels.

It is important to note that in moving from the circle to the triangle we lose one dimension! The magnitude of that loss must never be underestimated. This loss of one-third of the dimensions must be compensated for in some manner if mathematics is to retain its full meaning and effectiveness.

The third element in the model is the square. The square is a pictorial or graphical representation. It is a two-dimensional illustration of a three-dimensional world. The square may be used to represent a graph, map, photograph, house plan, etc. Anything that is drawn to represent some aspect of the real world is properly depicted by the square.

If we move from the circle to the square, we have again lost one dimension. Such a movement would be illustrated by the taking of a photograph or satellite weather map, activities where the viewer does not first go through the triangle. Just as a photograph is not as satisfying as the real thing, so the square is not as satisfying as the circle. But a graph or illustration still has great value, often clarifies a concept or relationship, and is an essential tool in the study of mathematics.

An architect formulates a mental picture of a three-dimensional structure (a mental form of circle activity) and then draws plans on sheets of paper (an activity denoted by the square), moving from the circle to the square. On the other hand, the builder studies the sheets of paper and uses that information to construct the structure, moving from the square to the circle. A second example is that of using a two-dimensional road map (square) and translating the information into the three-dimensional world (circle) to find a certain destination.



The movement from the triangle to the square is exemplified in drawing a graph given a table of information. Suppose information has been entered into a table in the form of ordered pairs. Using this information, we draw a graph, a frequent activity in algebra.

The reverse movement from the square to the triangle can take many forms. Suppose you wanted to find the airline distance between two cities on a map. You would make a measurement of the distance on the map and apply the scale ratio to determine the distance in the real world, moving from the square to the triangle.

Finally, we come to the fourth and last element in the Model, the hexagon. The hexagon represents a generalization, hypothesis, formula, or conclusion. It responds to the question, "What's the rule?"

Day by day we observe the behavior of another person (the circle). We begin to draw certain conclusions (the hexagon) by which we can predict the person's behavior in given situations. The movement has been directly from the circle to the hexagon. This is a very common form of human behavior, one in which we engage many times daily. If we observe an event in the real world and note that it seems to occur in a regular pattern; and if we generalize that pattern in our mind, we have moved from the circle to the hexagon. For example, a young child learns from repeated trials that if a stack of blocks is pushed over, the blocks will fall, scatter over the floor, and make a noise. As soon as the child makes that generalization, he anticipates with glee the consequences of giving such a stack of blocks a shove! First, the child made the generalization, moving from the circle to the hexagon. Next, the child applies the generalization, moving from the hexagon to the circle. The child is so confident of the result that he begins to laugh even before the event takes place.

We can move from the triangle to the hexagon by observing a sequence of numbers such as 1, 2, 4, 8, 16,

continued on page 8

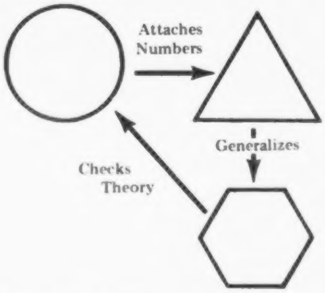
A Model of Mathematics

..., studying the sequence; and arriving at the conclusion or generalization that each number is double the previous number. From that generalization we can predict successive numbers in the pattern or, at a higher level, the number in the nth term. Such a prediction is moving from the hexagon to the triangle.

The movement from the square to the hexagon comes from studying an illustration and drawing a conclusion. We study two routes on a map and conclude that one is more desireable than another. Or, we see the graph created in an AIMS investigation and note that the broken line forms something approximating a straight line. Knowing that a straight line in such a graph means that a rule has been discovered, we deduce the rule. An example might be the manner in which a ball bounces. Dropped from various heights, the height of the bounce is measured and graphed. The points on the graph show a definite relationship: the height of the bounce is related directly to the distance dropped.

The movement from the hexagon to the square consists of using an illustration to picture a generalization. That illustration could even consist of interpretive doodling. In grammar we diagram sentences to show relationships, an illustration of this type of movement.

Regardless of whether the generalization is made by direct observation of an event, by noting a pattern in a set of numbers, or seeing a pattern in a graph, the construction of the generalization is a very important, uniquely human activity. The late I. J. Quillen, former Dean of the School of Education at Stanford University, concluded that the ultimate, all encompassing purpose of education is to **help our students become good hypothesis makers!** It is a goal that we need to ponder. If we teach our students to carefully examine all available evidence bearing on a matter before arriving at a conclusion and then to draw an unbiased conclusion, we will make a significant contribution to the well-being of our citizenry.



We can now look at the work of the scientist in terms of the Model. An experiment takes place in the real world (circle). Numerical information is obtained and entered into a table (triangle). The information might be graphed (square) for additional clarity. The information in the table and/or graph is studied to determine what is going on. If a pattern emerges, it is generalized (hexagon). Now that the scientist has developed a hypothesis, the work has only begun. The hypothesis must be tested under the most trying circumstances in the real world. Thus, this route is repeated over and over again: circle to triangle to hexagon to circle to triangle to hexagon... etc. Or, if the graph is involved the cycle starts: circle to triangle to graph to hexagon to circle...etc.

In the next installment we will see the Model of Mathematics as a diagnostic instrument for determining the mathematical completeness of daily mathematical activities in our classrooms.

Your Students Can Be Problem Solvers!

Wilbert Reimer

(Ed. Note: This is the third and final installment in the series.)

These question—helps towards discovering Level II Solutions—are summarized in the model illustrated here.

	—	—	Question 1	—	—
PROBLEM	—	—		—	—
	—	—	Question 2	—	—
	—	—		—	—
	n	?	Question 3	n	Solution

QUESTION 1: Are the numbers in the second column square, triangular, or powers of two?

QUESTION 2: Do the numbers in the second column increase by odds, consecutively, or by powers of two? If so, set up a helping column.

QUESTION 3: Do the numbers in the second column have a property in common? If so, set up a helping column.

The above questions are only suggestions which may be helpful in the search for Level II Solutions. Several of the poster problems can not be solved by using the model outlined here. These may be solved by using another technique, the Method of Finite Differences. This approach is explained in the appendix and in the commentary for the problems to which it applies.

Students will often find their own paths to solutions and should be commended for these approaches. In fact, they should be encouraged to try to solve problems using more than one method. Remember what George Polya said:

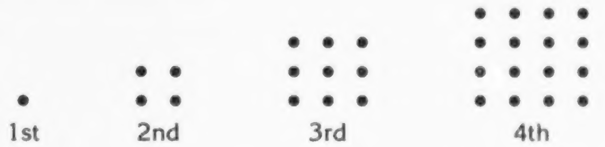
> "It is better to solve one problem five different ways than to solve five different problems."

continued on page 9

SQUARE NUMBERS

The square numbers are numbers that belong to the sequence 1, 4, 9, 16, 25, 36, 49, etc. We recognize, of course, that these numbers are obtained by squaring the counting numbers 1, 2, 3, 4, 5, 6, 7, etc.

We can also look at the square numbers pictorially. Four is a square number because with four dots we can make a square. The first four square numbers are pictured below.



We will refer to 1 as the first member of the square number family, to 4 as the second member, to 9 as the third member, and to n^2 as the nth member of the family.

An interesting characteristic of the square numbers is that their increases are odd.

The increases for the squares

1, 4, 9, 16, 25, 36, 49, 64, ...

are

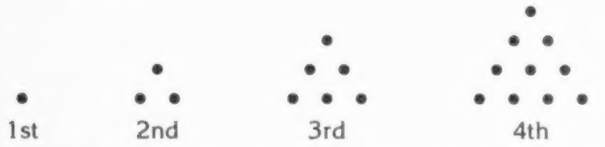
3, 5, 7, 9, 11, 13, 15, ...

Any sequence of numbers which increases by odds is related to the square numbers.

One of the poster problems asks students to discover properties of square numbers.

TRIANGULAR NUMBERS

Triangular numbers are numbers which can be represented by dots in an equilateral triangular array. The first four triangular numbers are pictured below.



The number of dots needed to construct a particular triangular number is known as its value. Hence, the 1st triangular number has a value of 1, the 2nd triangular number has a value of 3, the 3rd a value of 6, the 4th a value of 10, etc.

The general rule for finding the value of the nth triangular number is

$$\text{Value} = \frac{n\,(n+1)}{2}$$

Example: The 40th triangular number has a value of $\frac{(40\times41)}{2} = 820$. That is, it would take 820 dots to draw the 40th triangular number.

An important fact about the triangular numbers is that their increases are consecutive. Consider the first few triangular numbers:

1, 3, 6, 10, 15, 21, 28, 36, ...

Note that their increases are

2, 3, 4, 5, 6, 7, ...

These increases can be described as consecutive. Any sequence of numbers which increases consecutively is related to the triangular numbers.

The triangular numbers appear in the third column of Pascal's Triangle.

One of the poster problems deals with the pictorial representation of the triangular numbers.

POWERS OF TWO

The numbers in the sequence

1, 2, 4, 8, 16, 32, 64, 128, ...

are called powers of two. They are called this because they can be written as

$2^0, 2^1, 2^2, 2^3, 2^4, 2^5, 2^6, \ldots$

A property of powers of two is that their increases are also powers of two.

Look at the increases for

1, 2, 4, 8, 16, 32, 64, 128, ...

The increases are 1, 2, 4, 8, 16, 32, 64, ...

Any sequence of numbers which increases by powers of two is related to powers of two.

The sums of the rows in Pascal's Triangle are powers of two.

PASCAL'S TRIANGLE— THE SOURCE OF MANY PATTERNS!

Below is shown a triangular array of numbers known as Pascal's Triangle. While this illustration has 10 rows, Pascal's Triangle may be continued indefinitely. Each row begins and ends with a 1. The other numbers may be found by adding the two closest numbers in the row directly above.

```
                  1
                1   1
              1   2   1
            1   3   3   1
          1   4   6   4   1
        1   5  10  10   5   1
      1   6  15  20  15   6   1
    1   7  21  35  35  21   7   1
  1   8  28  56  70  56  28   8   1
1   9  36  84 126 126  84  36   9   1
```

Pascal pointed out many patterns found in this triangle.

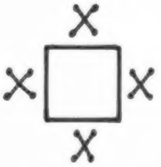
Several of the posters are designed to allow students to discover patterns found in Pascal's Triangle.

In the process of problem solving students should be reminded and encouraged to refer frequently to Pascal's

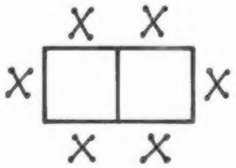
continued on page 31

A Banquet At Tony's

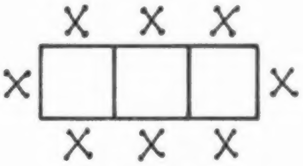
Tony's Restaurant has 10 small tables to be used for a banquet. Each table can seat only one person on each side. If the tables are pushed together to make one long table, how many people can sit at the table? Solve this problem by first counting how many people can be seated around 1 table, 2 tables, 3 tables, etc. until you see the pattern. Use the pattern to solve the problem.



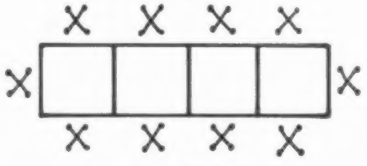
1 Table



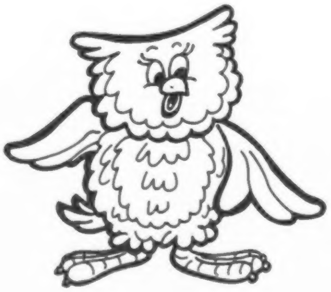
2 Tables



3 Tables



4 Tables



NUMBER OF TABLES	NUMBER OF PEOPLE
1	4
2	6
3	
4	
5	
6	
7	
8	
9	
10	
. . .	. . .
30	
n	

Can you discover the relationship between the number of tables and the number of people?

Try to determine how many people can be seated using 30 tables without continuing the chart.

How many people can be seated using n tables?

The Magic Circle!

Ted Ostrander and Arthur Wiebe

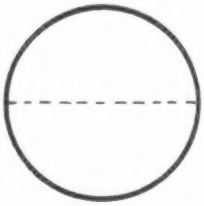
A simple circular piece of paper can teach a surprising number of geometric concepts! Your students will be continuously involved as they fold and unfold, observe, compare, and draw conclusions. By being engaged in a hands-on activity, students will experience geometric concepts in a real world context.

For this activity cut out circles about 25 centimeters (9-10 inches) in diameter out of newspaper or similar material. Each student and the teacher need a circle in order to act upon, feel, see, and discuss each step.

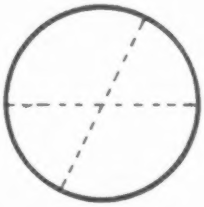
A circle is formed on a piece of paper by a line that is the same distance from a specific point called the center of the circle.

In this article the hands-on activities are indicated by bold type. The answers to the discussion questions are given in parentheses. It is recommended that each question be thoroughly discussed so students learn new terms, concepts, and facts.

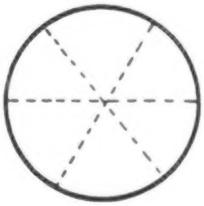
For use with students, take a few steps at a time. The sequence is presented here in its entirety only for the purpose of showing the broad scope that is possible. The first time through, it might be advisable just to do the folding as outlined in bold type. This could then be followed by studying the questions after each fold.



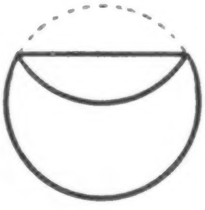
1. **Using the paper circle, fold the circle in half.**
   a. What is this new shape called? (Semi-circle)
   b. What is its straight edge called? (Diameter)
   c. Define a diameter. (The longest line segment with endpoints on the circle)
   d. How much of the area of the circle is in the semi-circle? (One-half).
   e. How can you find the center of the circle? (Fold another different semi-circle).



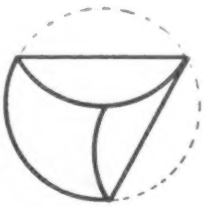
2. **Open the circle. Fold a second semi-circle. Mark the point where the diameters intersect.**
   a. Open the circle. What can you say about the two diameters? (They intersect at the center of the circle, bisect each other and are congruent.)
   b. What is the line segment that is one-half the diameter called? (Radius).
   c. The plural of radius is radii. How many radii can you see? (Four)
   d. A sector of a circle is formed by two radii and the arc connecting an endpoint of each. How many sectors do you see? (Four).
   e. How do the shape and size of opposite sectors compare? (They are congruent: same size and same shape.)
   f. How does the measure of opposite angles compare? (It is the same. The angles are congruent.)
   g. What shape do any two adjacent sectors form? (Semi-circle).
   h. What is the sum of any two adjacent arcs? (180 degrees or a semi-circle.)
   i. If two adjacent sectors are combined, how does their area compare with the area of the circle? (It is one-half the area of the circle.)



3. **Fold a third semi-circle.**
   a. What can you say about the three diameters? (They are congruent and intersect in the center of the circle.)
   b. How many radii do you see? (Six)
   c. Compare the radii. (They are congruent.)
   d. How many sectors do you see? (Six)
   e. What shape do any three adjacent sectors form? (Semi-circle).
   f. Complete this statement: "Any fold that passes through the center of the circle forms a ______? (Diameter)
   g. How many pairs of opposite angles are there? (Three)
   h. How does the measures of opposite angles compare? (They are the same.)



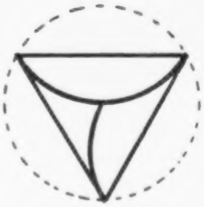
4. **Open up the circle and fold one edge of the circle to the center and fold.**
   a. What is the straight line segment formed by the fold called? (A chord. All folds with endpoints on the circle not passing through the center are called chords of the circle.)
   b. What is a special name for the arc that remains? (Major arc since its measure is more than 180 degrees.)



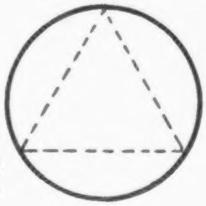
5. **Make a second fold to the center so that the end of the new chord meets an end of the first chord. Crease.** The figure now resembles an ice cream cone.
   a. What elements form its boundary? (Two chords and an arc)

continued on page 12

b. What part of the circle is in the intercepted arc? (⅓)
c. What is the measure of the arc? (120 degrees)
d. What is the angle formed by the two chords called? (Inscribed angle)
e. What is the measure of the inscribed angle? (60 degrees)
f. How does the measure of the angle compare with the measure of the arc? (It is ½ the measure of the intercepted arc.)

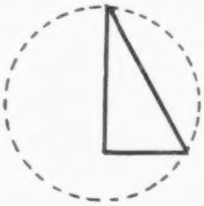


6. **Make a third fold to the center so that the ends of the new chord meet the remaining ends of the previous two chords. Crease.**
   a. What is the shape that is formed called? (Equilateral triangle)
   b. How do the measures of the sides of the equilateral triangle compare? (They are congruent.)
   c. How do the angles of the equilateral triangle compare? (They are congruent.)
   d. Is the area of the equilateral triangle more or less than one-half the area of the circle? (Less than one-half since the triangle is completely double covered everywhere and partially triple covered.)
   e. Given that the sum of the measures of angles of a triangle is 180 degrees, what is the measure of each of the angles? (60 degrees)
   f. In this figure a vertex is formed where two chords meet. How many vertices do you see? (Three)

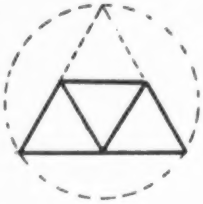


7. **Open up the circle. Note that the equilateral triangle is inscribed in the circle; that is, each vertex is on the circle.**

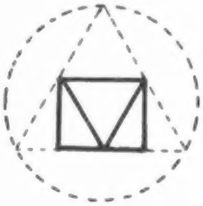
   How does the area of the equilateral triangle compare with the area of the circle outside the triangle? (It is less than one-half since the outside will cover all of the triangle at least twice and some of it three times.)



8. **Fold back into an equilateral triangle. Find the midpoint of one side. Make a fold passing through this midpoint and the opposite vertex.**
   a. What type of triangle is formed? (Right triangle)
   b. What is the measure of each of its angles? (90, 60, and 30 degrees.)
   c. The longest side of this right triangle is called the hypotenuse. The shorter two sides are called legs. How do the lengths of the legs compare? (The shorter is one-half the hypotenuse or longest side.)
   d. What is the measure of the angle opposite the hypotenuse? (90 degrees)
   e. What is the measure of the angle opposite the shorter leg? (30 degrees)
   f. What is the measure of the angle opposite the longer leg? (60 degrees)
   g. How does the area of the right triangle compare with that of the equilateral triangle? (It is one-half that of the equilateral triangle.)



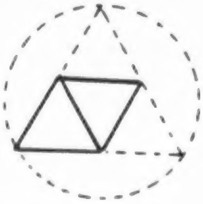
9. **Open up into the equilateral triangle. Bring one vertex of the triangle to the opposite mid-point of a side and crease well.**
   a. What type of figure is formed? (Isosceles trapezoid)
   b. Compare one set of opposite sides of the trapezoid. What do you observe? (In one set the sides are congruent but not parallel. In the other the sides are parallel but not congruent: one is twice the length of the other.)
   c. Compare the second set of opposite sides of the trapezoid. What do you observe? (The other condition above).
   d. How many triangles do you see? (Three are visible and and a fourth is under the center triangle.)
   e. How do the four triangles compare? (They are congruent.)
   f. How does the area of the trapezoid compare with that of the first large equilateral triangle? (It is three-fourths that of the triangle.)
   g. Explain your reasoning. (Since the first triangle has been divided into four congruent triangles and three form the trapezoid, the area of the trapezoid is ¾ that of the first triangle.)
   h. How does the area of the orginal equilateral triangle compare with that of the trapezoid? (It is ⁴⁄₃ that of the trapezoid.)
   i. How does the area of one of the four equilateral triangles compare with that of the trapezoid? (They are ⅓ the area of the trapezoid.)
   j. How does the area of one of the four triangles compare with that of the large equilateral triangle? (It has ¼ the area.)
   k. How does the perimeter of the trapezoid compare with that of the large equilateral triangle? (It is ⅚ as long.)



10. **Fold the second and third vertices to the same midpoint.**
    a. What type of figure is formed? (Rectangle)
    b. How does the height (or width) of this rectangle compare with the height of the original triangle? (½ as high)
    c. How does the length of this rectangle compare with length of the base of the original triangle? (½ as long)

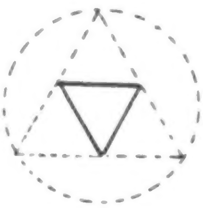
d. **If the base of the triangle is b and the height of the triangle is h, what are the dimensions of this rectangle? (½b by ½h)**
e. **What is the area of the rectangle? (¼bh)**
f. **What, then, is the area of the original triangle? (Twice as much or ½bh)**
g. **Note that the vertices of the triangle are all together. What is the sum of the measure of all three vertices? (A straight angle or 180 degrees)**

11. With the trapezoid, fold one of the outside triangles over the center triangle.



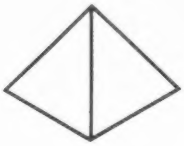
a. What figure is formed? (Rhombus)
b. How does the measure of the sides of the rhombus compare? (They are equal.)
c. What can you say about opposite sides? (They are congruent and parallel.)
d. How do opposite angles compare? (They are congruent.)
e. How many small triangles do you see? (Two)
f. The area of the rhombus is what part of the area of the large triangle? (One-half)
g. The area of the rhombus is what part of the area of the trapezoid? (Two-thirds)
h. How does the area of the rhombus compare with that of the small triangles? (It is twice as large.)
i. Compare the area of the large triangle to that of the rhombus. (It is twice as large.)
j. Compare the area of the trapezoid to that of the rhombus. (It is 3/2 as large.)
k. How does the perimeter of the rhombus compare with that of the large equilateral triangle? (It is 4/6 or ⅔ as long.)
l. How does the perimeter of the rhombus compare with that of the trapezoid? (It is ⅘ as long.)
m. How does the perimeter of the large equilateral triangle compare with that of the rhombus? (It is 3/2 or 1.5 times as long.)
n. How does the perimeter of the trapezoid compare with that of the rhombus? (It is 5/4 or 1.25 times as long.)
A rhombus is a subset of the set of parallelograms.

12. Fold the remaining outside triangle over the center triangle.



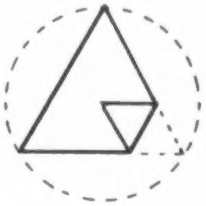
a. What figure is formed? (Equilateral triangle)
b. How does the area of this triangle compare with that of the rhombus? (It is one-half as large.)
c. How does the area of this triangle compare with the right triangle folded earlier? (The area of the triangle is ½ that of the right triangle.)
d. How does the perimeter compare with that of the rhombus? (It is ¾ that of the rhombus.)
e. How does the perimeter of the triangle compare with that of the trapezoid? (It is ⅗ that of the trapezoid.)
f. How does the perimeter of the triangle compare with that of the large equilateral triangle? (It is ½ that of the large triangle.)
g. How does the perimeter of the trapezoid compare with that of the small equilateral triangle? (It is 5/3 or 1⅔ as long.)
h. How does the perimeter of the rhombus compare with that of the small triangle? (It is 4/3 or 1⅓ as long.)
i. How does the perimeter of the large equilateral triangle compare with that of the small triangle? (It is twice as long.)

13. Open the figure to the original triangle. Fold the original triangle so the vertices meet to form a three-dimensional pyramid.



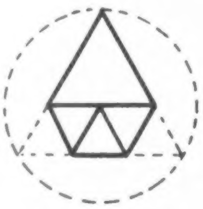
a. What is this figure called? (Tetrahedron. Tetra means four. It has four faces.)
b. What is the surface area of the tretrahedron if the area of the original triangle is 1? (Also 1)
c. What is the surface area of the tetrahedron if the area of one of the small triangles is 1? (4)
d. What is the surface area of the tetrahedron if the area of the trapezoid is 1? (4/3)
e. What is the surface area of the tetrahedron if the area of the rhombus is 1? (2)

14. Open the figure to the original triangle. Fold one vertex to the center of the circle. (Make the folds in Steps 13, 14, and 15; then return to the condition in this step. The triangles will be easier to visualize.)



a. What new figure is formed? (Isosceles trapezoid) Explain the answer.
b. How does the area of this trapezoid compare with the original triangle? (It is 8/9 as large.)
c. How does the perimeter of this trapezoid compare with that of the original triangle? (It is 8/9 as long.)
d. How does the short base of the trapezoid compare with the long base? (It is ⅓ as long.)

15. Fold a second vertex to the center.



a. What is the new figure called? (Pentagon)
b. How does the area of the pentagon compare with that of the original triangle? (It is 7/9 as large.)

continued on page 30

BALANCING FORKS

GENERAL INFORMATION

To understand why the forks and the potato can be balanced on the side of a glass students must know a few things about balance.

1. All things have a **center of gravity**—This is a point where most of the weight of an object seems to be centered. The center of gravity of a round flat object, such as a dime, is directly in the center.
2. The center of gravity of an irregularly shaped object, such as a piece to a puzzle, is not usually in the center of the object.
3. The center of gravity of some objects, such as kidney shaped objects, is not always located on the object.
4. The center of gravity tends to move as low to the ground as possible. As it does this it becomes more stable and better balanced.
5. When the center of gravity is below the balance point, the object becomes even more stable or balanced.

MATERIALS

The end of a cucumber can also be used to anchor the forks. Use a tall glass or jar so the forks don't touch the table top.

PROCEDURE

You might have to adjust the forks a couple of times before you get it to balance—don't give up because the students will be suprised at the results. After it's balanced and the match is burning, extinguish the flame before it crosses over the edge of the glass. Gently stroke the charred wood so it drops down into the glass.

POSSIBLE ANSWERS

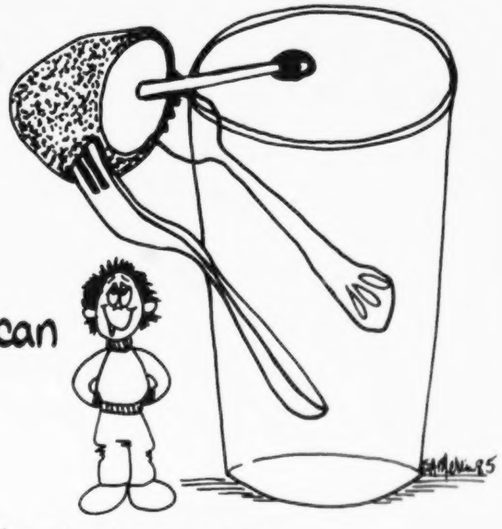
1. The center of gravity (where most of the weight is centered) is below the balance point on the lip of the glass.
2. No. The forks cannot be balanced when they are positioned above the glass.
3. Answers will vary. Alter the angles and try to balance it.
4. Football and basketball players crouch down to lower their body's center of gravity to improve their balance.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Have students list the ways they might have seen a low center of gravity used to improve performance in everyday life. Some suggestions might include:

1. Race cars are built with the chassis as low to the road surface as possible so they maintain their balance on turns. The same is true of sport cars.
2. Tightrope walkers hold a pole to lower their center of gravity and adjust their balance.
3. Snow skiing, water skiing, and skateboarding performance is improved as a person's weight (or center of gravity) is lowered by moving to a crouching position.

Balancing Forks



Materials:

Two forks
End of a potato
Tall glass or empty gallon can
Match stick

Procedure:

1. Cut off the end of a potato so that it is two inches wide.
2. Push the forks into the potato so that they form a 45° angle - the top side of the fork handles should face in toward the glass.
3. Anchor the wooden match in the potato by pushing it in about an inch. The head of the match should face out.
4. With the forks down below the mouth of the glass, place the matchstick on the edge of the glass. Try different positions until everything balances.
5. After the forks are balanced, light the head of the wooden matchstick with another match.

Questions:

1. Where is most of the weight of the potato and forks when they are balanced?

2. Could you balance it if the two forks were above the edge of the glass?

3. What might happen if the forks were placed at an angle less than 90°? More than 90°?

4. Do athletes such as football and basketball players have better balance when they are standing straight or are in a crouched position? How does this relate to the results of this experiment?

82

The Jar That Likes to Keep You Guessing

I. Topic Area

Estimation and number concept

II. Introductory Statement

Students will use a jar of small objects to build their skills in estimation, counting strategies, and place value.

III. Math Skills

Math Skills	Science Processes
a. Estimating	a. Predicting
b. Counting	b. Collecting Data
c. Place Value	c. Comparing
d. Grouping	d. Generalizing
e. Problem Solving	e. Applying Information
f. Graphing	

IV. Materials

4-6 small Mason jars filled with jelly beans, walnuts, marbles, Teddy Bear counters, spools of thread, and pencil erasers (or similar objects).

V. Key Question

How many ________________ are in the jar?

VI. Background Information

1. Estimating is a skill each of us needs in order to function successfully. As adults we often use it without conscious effort. Our ability to estimate well improves with experience. Even as adults, we are uncomfortable and inaccurate when estimating very large or very small numbers. For example, can you picture a billion of something or describe a millionth of something?
2. To encourage youngsters to "guess", ask if they can estimate within 5 or 10 of the correct number rather than asking for the exact number.
3. This activity may be adapted to any grade level simply by selecting a range of numbers appropriate to the grade level. The process of grouping by two's, three's, etc. may be related to a number of concepts—addition, multiplication, place value, fair shares, and other number bases.

VII. Management Suggestions

1. For convenience and safety, keep the Guessing Jar at school. Have the youngsters bring from home objects to count in Zip Lock baggies and then transfer them to the Guessing Jar.
2. Baby food jars may be substituted for small Mason jars.

VIII. Procedure

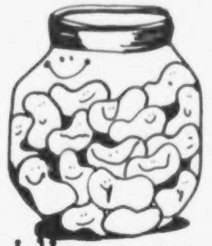
1. Begin by collecting a variety of small objects to be placed in the Guessing Jar. Duplicate the "home letter" and send the request home with each student. When the child returns with his contribution, transfer the objects to the "Guessing Jar."
2. Show the students the filled "Guessing Jar". Have the students estimate the number of objects in the Jar while you record their estimates on the overhead, chalkboard, or large chart paper.
3. After 10-15 estimates have been recorded for all to see, ask very specific and creative questions about their estimates. For example, Does anyone see a number greater than 29? Is there a number with a 3 in the tens place? a 5 in the ones place? an odd number? and so forth. The kinds of questions asked will be determined by the appropriateness for the grade level.
4. Students may use the "Guessing Jar" recording pages to make a record of the counting methods used to count the objects in the jar.
5. On the first activity page, the student identifies the objects by naming them and then estimates the total number.
6. Draw a picture or sketch of the Guessing Jar.
7. The teacher pours out the contents of the Jar on the overhead or table nearby and leads the students in grouping the items by tens. You may wish to place each group of ten objects into a paper cup. Then count and record the number of tens and the number of ones. Discuss what happens if you reverse the number of tens and the number of ones.
8. Keep a daily record that shows a picture of the objects and the total number so that students can refer to past experience in making future estimates.
9. The second and third activity pages may be used to record estimates and place value counting methods for several different small jars of objects. One page is formatted with selected objects. The other is open-ended to include your choice of objects. Students work in small groups and record their estimates and then group by tens and ones as modeled by the teacher. Record in the appropriate place and exchange jars with another group. Continue until all jars have completed the rounds.
10. The fourth activity page allows youngsters to use the Guessing Jars to make fair shares. Students begin by identifying and naming the objects in the jar and recording their estimates of the total number.
11. Fair share the objects in the jar with two people (you and a friend). Record how many two's and how many left over. Then shade or color in the number of objects by two's in the grid. How many all together? Translate this information into mathematical language by filling in the equation: (______ × 2) + ______ = ________.
12. Repeat a similar procedure for fair shares with three people, and with 5 people.

IX. Discussion

Discussion questions of a specific nature have been included in the above described procedures. More general types of questions may be included in further discussion.

1. If the Guessing Jar is filled with objects that are smaller than the objects used today, will my estimate be higher or lower?
2. How does shape affect the number of objects in a jar?

continued on page 21



Dear Parents,

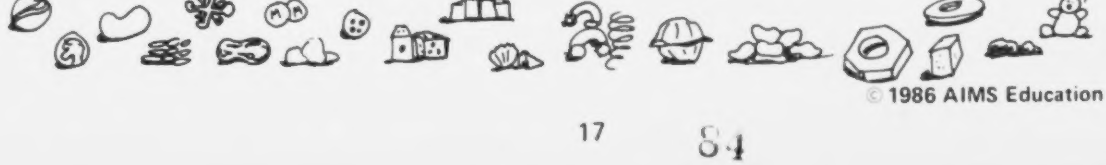
This is a picture of the "jar that keeps us guessing." Please help your child find a number of small items that will fit in the jar (10-25 in the fall, 10-50 in the winter, 10-100 in the spring). Then, count the items with your child and send them to school in a plastic Zip Lock baggy.

Instruct your child not to tell anyone how many items are in the baggy.... not even their best friend! The class will transfer your contribution to the "jar" and will estimate the number of items in the jar. We will group them and count them in a variety of ways. Thank you for your help.

Your child's teacher,

Sample objects might include:

marbles
pennies
rice
beans
macaroni
balls
jacks
peanuts
erasers
pebbles
BB's
M&M's
buttons
cereals
popcorn
dice
wooden blocks
tiny toys
sea shells
pom poms
gum balls
candies
small tiles
styrofoam beads
pasta
lima beans
coffee beans
pinto beans
walnuts
plastic beads
hazel nuts
game pieces
jelly beans
sugar cubes
jelly bellies
nuts, bolts
washers
filberts
raisins
gummy bears



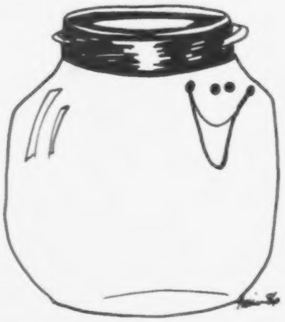
Guessing Jar

____
Name

Today, our jar is keeping us guessing about ____________.

My guess is ____________.

This is a picture of the guessing jar and the ________ inside.



Make a record:

Tens	Ones

There were _____ tens and ______ ones.

All together there are __________.

My guess is _____ more than we counted

or _____ less than we counted.

The number we counted is odd or even.
(circle one)

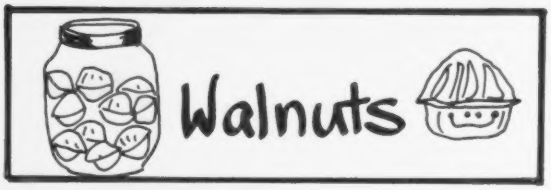
Guessing Jars

Name ____________________

Jelly Beans

Guess: Total:

Tens	Ones


Walnuts

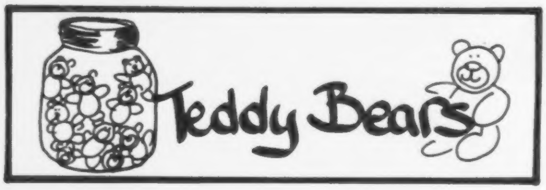
Guess: Total:

Tens	Ones

Marbles

Guess: Total:

Tens	Ones


Teddy Bears

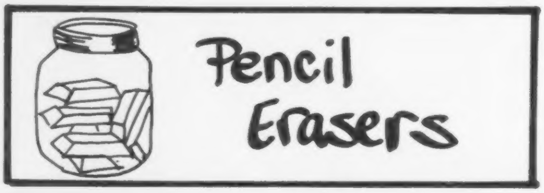
Guess: Total:

Tens	Ones

Spools of Thread

Guess: Total:

Tens	Ones


Pencil Erasers

Guess: Total:

Tens	Ones

Name ______________

Guessing Jar - Making Fair Shares

Today, our jar is keeping us guessing about __________.

My estimate is __________.

1. Fair share the objects in the jar with 2 people (you and a friend).
How many twos? ______ How many left over? ______

Color in the number of twos and any left over.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Number of Twos

• How many all together? ______. AHA! (___ x 2) + ___ = ___

2. Fair share the objects in the jar with 3 people (you and 2 friends).
How many threes? ______ How many left over? ______

Color in the number of threes and any left over.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Number of Threes

• How many all together? ______. AHA (___ x 3) + ___ = ___

3. Fair share the objects in the jar with 5 people (you and 4 friends).
How many fives? ______ How many left over? ______

Color in the number of fives and any left over

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Number of Fives

• How many all together? ______

AHA (___ x 5) + ___ = ___

How Many BBs In the Jar?
BBs In the Jar

I. Topic Area

Alternatives to counting

II. Introductory Statement

Students will find alternatives to counting for determining the number of objects when counting is too tedious and time consuming. Two options are offered: How Many BBs in the Jar? asks students to decide what alternative to counting they will use; BBs in the Jar outlines the procedure.

III. Math Skills

Math Skills	Science Processes
a. Estimating	a. Estimating
b. Devising a Plan	b. Sampling
c. Selecting the Size of a Sample	c. Measuring Mass
d. Counting	d. Collecting and Recording Data
e. Using Ratio and Proportion	e. Generalizing
f. Averaging	f. Interpreting
g. Computing Percent of Error	g. Applying

IV. Materials

A supply of BBs. These can be purchased at K-Mart and similar outlets and usually come 2500 to a carton. Each jar should have about 50 BBs, but the number need not be the same jar to jar.

Small jars for holding BBs

Scales and masses

Student worksheets: choice of structured or open-ended approach

V. Key Questions

How can you find the number of BBs in the jar without counting all of them? How are objects counted for packaging in industry?

VI. Background Information

The cartons in which BBs are packaged give the number of BBs contained in them. How did the packager know?

Weighing is a common method used in industry to determine the number of objects with reasonable accuracy. In this experience students will likely select this method and determine its validity.

VII. Management Suggestions

Either approach or lesson works well when students are organized into cooperative learning groups of four or five. The time required is about forty minutes.

VIII. Procedure

1. Organize students into cooperative learning groups of four or five each.
2. Provide each group with a small jar containing about 1250 BBs.
3. Let students discuss what method is best for making a good guess as to the number of BBs. This is an important problem solving stage in which students should have sufficient time to compare methods and discuss the merits of each.
4. With the unstructured approach have students discuss methods for determining the number of BBs with a high degree of accuracy and then use the method or several methods to make the determination.

   In the structured approach have students find the information required in the table following the procedure outlined.
5. After the number of BBs has been determined by the student selected method(s), have students find the answers to the final three questions on the student worksheets and discuss how they solved the problems.

X. Discussion

1. What methods were used in making the guesses? Which was best?
2. What methods were used to determine the number of BBs with a high degree of accuracy? Which was best?
3. What relationship is there between the number of BBs and their mass?
4. How can we find the average mass of one BB?
5. How can we find the approximate number of BBs per gram?
6. How can we find the mass of a million BBs?
7. How can we find the number of BBs with a mass of about one Kilogram?
8. Can we justify the use of massing by industry to make sure that the required number of objects are placed into a package? Explain.
9. How can a packager make sure that the buyer will have the number of objects named on the package?

XI. Extensions

1. What are some other objects that could be "counted" by massing?
2. What objects would be difficult to "count" by massing?
3. Repeat the investigation with other uniform objects such as M and Ms, beans, marbles, etc.

---

continued from page 16

3. Will a jar hold more marbles or more crayons?
4. What kinds of objects fill more space than others?
5. Can I fill *all* the space in a jar with "countable" objects?

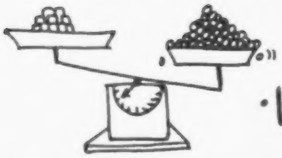
X. Extension

1. When students become very confident, you may wish to combine more than one kind of item in the Jar. For example, large marbles and small marbles.
2. At holidays, you may wish to fill a Jar with individually wrapped holiday candy for estimating and distribute for a treat.

BBs in the JAR

____
Name

How many BBs are there in the jar?



· What is the mass of one BB?

Record the estimates of each member of your group in the table. Later, find the per cent of error for each and the average of the group.

Name of Member	Estimate of:		Calculated:		Per Cent of Error of:	
	# in Jar	BB mass	# in Jar	BB mass	# in Jar	BB mass
Total:				Total:		
Average:				Average:		

Now use the indicated sample sizes to find the approximate mass of one BB and from that, the calculated approximate number of BBs in the jar.

Number of BBs in Sample	Mass of Sample	Mass of One BB	Mass of BBs in Jar	Calculated # of BBs in Jar
50				
100				
150				
200				

The approximate mass of one BB is ______ gram(s).
The approximate number of BB's per gram is ________.
The approximate mass of 1,000,000 BBs is ______ Kgs.
Describe the method you used to find the approximate mass of 1,000,000 BBs.

Name: ______________________

How Many BBs in the Jar?

Examine a jar of BBs. Make your best guess as to the number of BBs in the jar. Then, explain what strategy you used to arrive at your guess.

My guess is that there are ______ BBs in the jar.
I arrived at my guess by ______________________
____

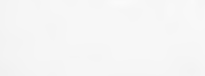
Record the estimates of each member of your group in the table. Later, find the per cent of error for each and the average for the group.

Name of Member	Estimate of:		Calculated:		Per Cent Error of	
	# in Jar	BB Mass	# in Jar	BB Mass	# in Jar	BB Mass
Total:			Total:			
Average:			Average:			

As a group, decide on a procedure for determining the number of BBs in the jar with a high degree of accuracy that does not involve counting all the BBs.

____
____

Use your procedure. Then compare the results with both your guess and the results of other investigators, if any. Comparison with my guess: ______________________ Comparison of my results with results of other investigators: ______________________



What is the approximate mass of one BB? ______ gram
What is the approximate number of BBs per gram? ______
What is the approximate mass of 1,000,000 BBs in Kg? ______ Kg

CAN YOU PLANET?

I. Topic Area
Planets

II. Introductory Statement
Students will use a table of facts about the planets to fill in a Venn diagram, answer questions, and graph information.

III. Math Skills
- a. Graphing
- b. Computation With Whole Numbers
- c. Averaging
- d. Percent
- e. Attributes
- f. Problem Solving
- g. Set Theory

Science Processes
- a. Classifying
- b. Comparing Data
- c. Interpreting Data
- d. Predicting and Inferring
- e. Applying and Generalizing
- f. Drawing Conclusions

IV. Materials
Student Worksheets
Scissors
Pencils

V. Key Question
Using a Venn diagram, can we group information about the nine planets?

VI. Background Information
Information about the planets varies from book to book. New information is always being obtained. The children need to know that the information on the chart is as up-to-date as possible but may change. If you have not talked about Venn diagrams before, you should do a simple one as a class before attempting this page.

VII. Management
1. This activity will take about 45-60 minutes.
2. Students can work in pairs or small groups.
3. Discussion questions can be done orally or use the work page included.
4. Calculators can be used to do the averaging and percent.
5. After working with the individual Venn diagrams, a large class diagram can be made and displayed.

IX. Procedure
1. Students will read information on the chart.
2. Students will fill in the Planetary Helping Table.
3. Students will cut planets on dotted lines or may use planet symbols, or names.
4. Students will use the information on the Helping Table to place the planets in the appropriate circles or intersections on the Venn diagram.
5. Discuss similarities and differences about the planets based on the Venn diagram.
6. Perform a variety of mathematical problems orally or on the worksheet, using the information from the diagram and chart.
7. Use the information from the diagram to fill in the graphs, how many moons, and what's my size. Use different colors for each bar on the graphs.

X. Discussion
The Diagram:
1. Which planets are larger than the earth?
2. Which planets have moons?
3. Which planets have days longer than 24 hours?
4. Which planet fits all three categories?
5. Which planets have no moons?
6. Which planets are smaller than the earth?
7. What percent of the planets have moons?
8. What percent of the planets are smaller than the earth?

The Chart
1. Which planet has the most moons?
2. What is the total number of moons?
3. What is the average number of moons?
4. Which two planets are the closest in size?

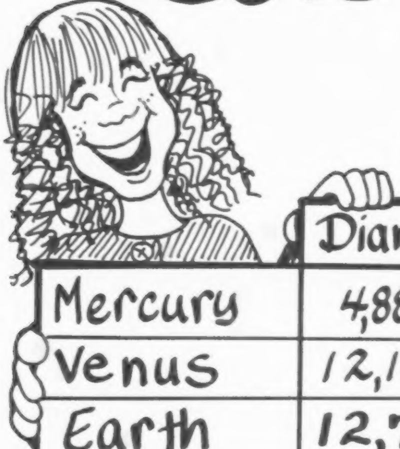
XI. Extensions
1. Using the cutouts, arrange the planets in order from smallest to largest, longest day to shortest day, number of moons, etc.
2. Have students do research reports on individual planets.

Note: Can You Planet and Planetary Facts are taken from the forthcoming publication Out of This World, scheduled for publication in late November or early December. The entire book is devoted to a study of the solar system.

The fact sheet on Page 28 may be used in conjunction with the "helping table" on the bottom of Page 24. Either students or the teacher select three aspects to be used in classifying the planets in the Venn Diagram on Page 29.

Name: ______________________

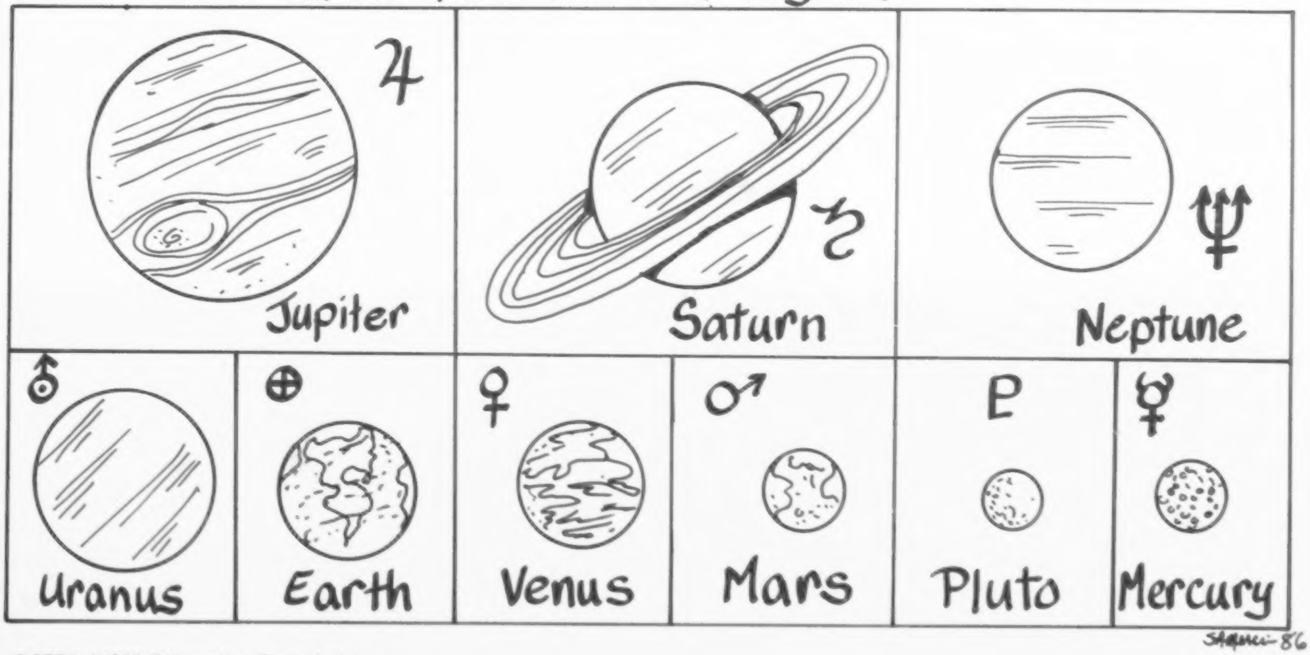
CAN YOU PLANET?



PLANETARY FACTS

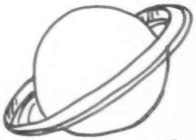
	Diameter	Moons	Length of Day
Mercury	4,880 Km	0	59 days
Venus	12,104 Km	0	243 days
Earth	12,756 Km	1	23 hours 56 minutes
Mars	6,787 Km	2	24 hours 37 minutes
Jupiter	142,800 Km	16	9 hours 55 minutes
Saturn	120,600 Km	20	10 hours 14 minutes
Uranus	50,800 Km	15	24 hours
Neptune	48,600 Km	2	22 hours
Pluto	3,000 Km	1	6 days 9 hours

Cut out & use for Venn Diagram

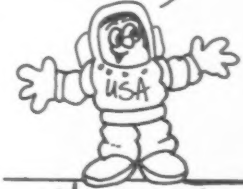


Name ______________________

CAN YOU PLANET?

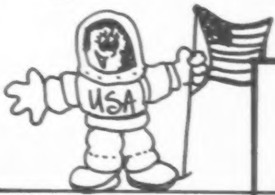


Sort out the planets. Next to each planet's name, color in those spaces that are true. Use this information to place the planets on the Venn Diagram.



Planetary Facts Helping Table

	Larger than Earth	Day 24 hours or More	Has Moon(s)
Mercury			
Venus			
Earth			
Mars			
Jupiter			
Saturn			
Uranus			
Neptune			
Pluto			



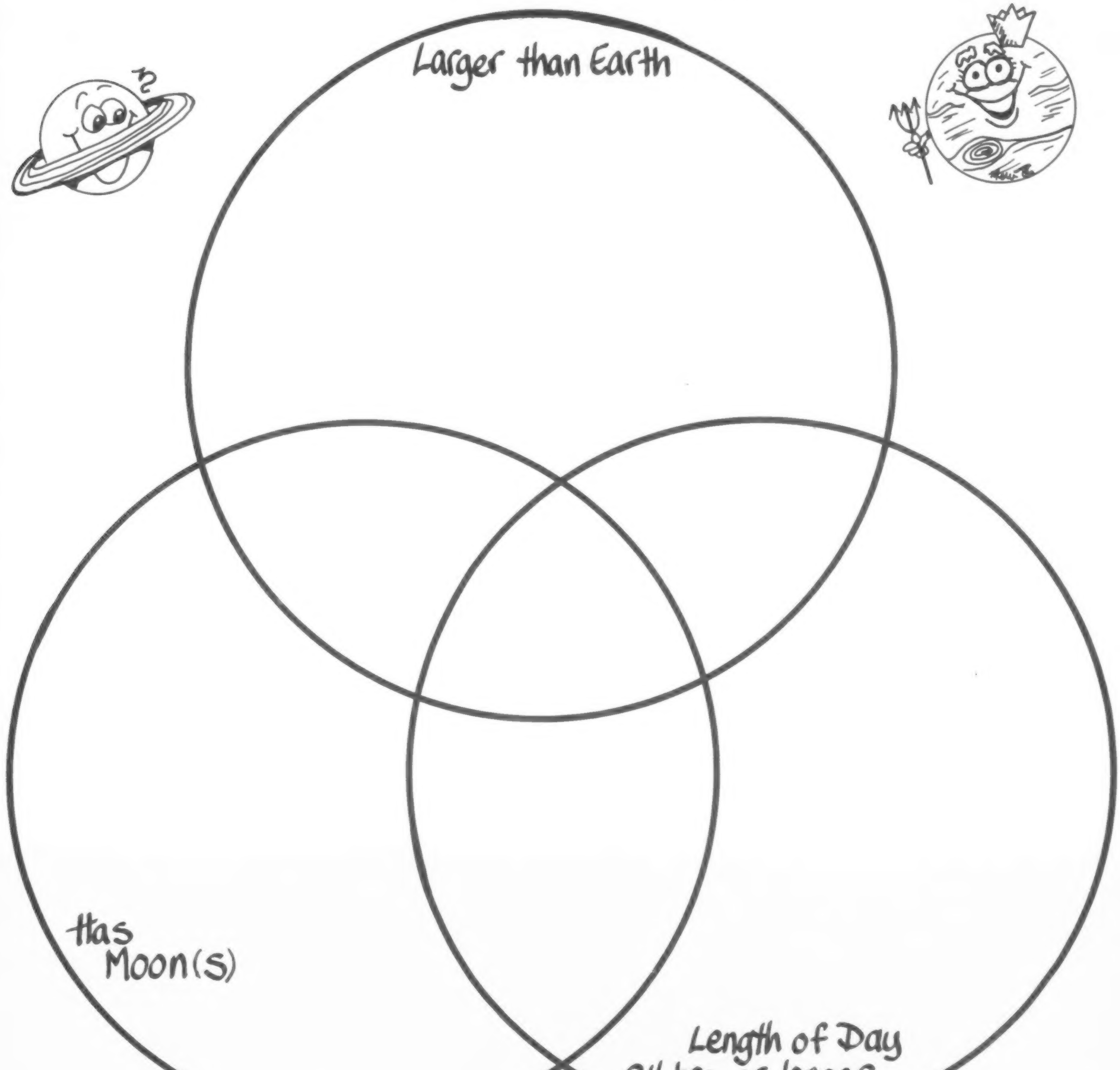
More Planetary Facts (Venn Again)

Mercury			
Venus			
Earth			
Mars			
Jupiter			
Saturn			
Uranus			
Neptune			
Pluto			

CAN YOU PLANET?

Name: ____________________

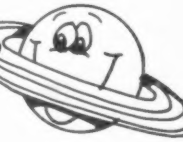
Cut apart the planets from the previous page. Use the information from the chart to place the planets in the correct circle or junction of circles.



Name: ____________________

CAN YOU PLANET?

Use the Venn Diagram or chart to answer the following questions.



1. Which planets are larger than Earth? ____________________

2. Which two planets are closest in size? __________ __________

3. What percent of the planets are smaller than Earth? __________

4. Which planets have moons? ____________________

5. Which planet has the most moons? ____________________

6. What is the total number of known moons in our solar system? ____________________

7. What is the average number of moons per planet? __________

8. Which planet fits into all three categories? ____________________

9. Which planets have days which are longer than 24 hours?

____

Think of two more questions you can ask your classmates. Write them below.

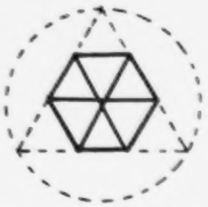
PLANETARY FACTS

Name ____________________

	Distance from Earth in Millions of Km	Density	Surface Gravity	Distance from Sun in Millions of Km	Mass	Length of Year
Mercury	85	5.4	.39	58	.055	88 days
Venus	40	5.3	.91	108	.815	225 days
Earth	0	5.5	1	150	1	365 days
Mars	56	3.9	.38	228	.107	687 days
Jupiter	628	1.3	2.60	778	317.9	11.86 years
Saturn	1,276	.7	1.07	1,427	95.2	29.46 years
Uranus	2,736	1.2	.90	2,870	14.6	84 years
Neptune	4,310	1.7	1.15	4,497	17.2	165 years
Pluto	4,345	.3-.8	.05	5,900	.002	248 years

c. How does the perimeter of the pentagon compare with that of the original triangle? (It is 7/9 as long.)
d. How does the area of the pentagon compare with that of the isosceles trapezoid in previous case? (It is 7/8 as large.)
e. How does the perimeter of the pentagon compare with that of the isosceles trapezoid? (It is 7/8 as long.)

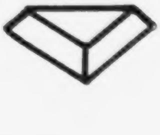
16. Fold the third vertex to the center of the circle.



a. What is the new figure called? (Regular hexagon) *A regular hexagon has all sides and interior angles congruent.*
b. How many small triangles do you see? (Six)
c. How does the area of the hexagon compare with that of the original triangle? (It is 6/9 or 2/3 as large.)
d. How does the perimeter of the hexagon compare with that of the original triangle? (It is 6/9 or 2/3 as long.)
e. How does the area of the hexagon compare with that of the pentagon? (It is 6/7 as large.)
f. How does the area of the hexagon compare with the trapezoid in this sequence? (It is 6/8 or 3/4 as large.)
g. How does the perimeter of the hexagon compare with that of the pentagon? (It is 6/7 as long.)
h. How does the perimeter of the hexagon compare with that of the trapezoid in this sequence? (It is 6/8 or 3/4 as long.)
i. How does the area of the hexagon compare with that of the first trapezoid, not the one in this sequence? (The area of the hexagon is 2/3 or 8/12 that of the triangle and the trapezoid is 3/4 or 9/12 that of the triangle. Therefore, the area of the triangle is 8/9 that of the trapezoid.)
j. How does the area of the hexagon compare with that of the rhombus? (The area of the hexagon is 8/12 that of the triangle and the area of the rhombus is 1/2 or 6/12 that of the triangle. Therefore, the area of the hexagon is 8/6 or 4/3 that of the rhombus.)

It is clear at this stage that additional rather difficult comparisons could be examined. These are left up to the discretion of the teacher.

17. Open up the triangle. Tuck one of the small triangles at one of the vertices into the small triangle at one of the other vertices. Then tuck the triangle at the remaining vertex underneath the other two to form a three-dimensioned figure.



a. What is the new figure called? (It is a truncated tetrahedron. Truncated means it has a part that has been cut off.)
b. If the original triangle had an area of 1, what is the area of (1) the bottom base? (1/4)
(2) the top base? (1/9)
(3) a side face or wall? (1/4 − 1/9) (Note that together one side face and the top base are congruent to the bottom base.)
c. What is the total surface area of the truncated tetrahedron?
$[\frac{1}{4} + \frac{1}{9} + 3(\frac{1}{4} - \frac{1}{9})] =]\frac{9}{36} + \frac{4}{36} + 3(\frac{9}{36} - \frac{4}{36})] =$
$[\frac{13}{36} + 3(\frac{5}{36})] = \frac{28}{36} = \frac{7}{9}$.
d. Remembering Polya's advice that "it is better to work one problem five ways than to work five problems one way" can you think of another way to solve this problem? (When the truncated tetrahedron was formed, we hid exactly two of the small triangles. All the rest of the original triangle is to be found in the bases and side faces. Each of the hidden triangles had 1/9 the area of the original triangle. Therefore, 2/9 of that area was lost, leaving 7/9.)

18. Build a truncated tetrahedron that will just fit on top of this truncated tetrahedron.

Sleuthing Across America

Ann Wiebe

"Let's take the local train to Knoxville."

"No. I think we should get a ticket for Atlanta. From there, we can catch a rocket train to New York."

"Let's wait for the next train and build up our crystal supply."

These are some of the comments you might hear as students consult each other, train tables, and a United States map in order to solve the case posed by Scholastic's software program, Agent USA. The Project SETUP book, Sleuthing Across America, was written to link this software to the curriculum and to guide teachers in bringing out its problem solving potential. It includes step-by-step procedures, suggestions for classroom management in different settings, student activities, and background information on related topics such as time zones. Several of the forms can be compiled into an Agent Casebook. Ideas for further extending the experience into social science, language, art and math are included.

Somewhere in the continental United States, a FuzzBomb is loose. It turns the town's citizens into FuzzBodies. They in turn, board trains and spread the fuzz menace to other cities. Your mission is to find and disarm the FuzzBomb. You will need to collect 100 crystals to complete the job. Traveling is accomplished via a simulated network of local and rocket trains. Tickets are free, but keep an eye on your departure time. The onscreen digital clock also computes time zone changes.

Once acquainted with the software's many features, a plan is put into action. Information is gathered from train time tables and from the InfoBooth at any state capital. The United States map is referred to extensively as students chart the trip to their destination, a wonderful tie to the study of United States geography.

Sleuthing Across America provides some introductory activites on time zones, the locations of United States cities, and the postal abbreviations used in the train tables. But the central focus of the book is problem solving. Students learn to make and test hypotheses, organize information, use trial and error, work backwards, make generalizations, and develop persistence. A cooperative effort is helpful and recommended.

Like many worthwhile ventures, it takes time and the final goal is elusive. The authors, Ann Wiebe and Jane Wingfield, feel success should not be based solely on the disarming of the FuzzBomb, but on the growth in problem solving skills.

A challenging adventure awaits you!

Ann Wiebe is a 4th grade and mentor teacher in Kings Canyon Unified School District, Reedley, California; a writing team leader in Project AIMS; and a member of the Project SETUP writing team.

Triangle. There is much more here than first meets the eye!

We mention here but a few of the many patterns found in this remarkable triangle.

1. The sum of the rows follow the pattern 1, 2, 4, 8, 16, ... (powers of two.)
2. The sum of all the numbers in triangles with 1 row, 2 rows, 3 rows, etc. follow the pattern 1, 3, 7, 15, 31, ... respectively.
3. As we look down the columns (diagonally) we see all ones in the first column, the counting numbers in the second column, the triangular numbers in the third column, and the pyramid numbers in the fourth column.
4. The sum of the first n terms in any column is equal to the nth term in the next column. For example, the sum of the first three terms in column four is equal to the third term in column five, etc.

Students should be encouraged to study Pascal's Triangle and discover additional patterns on their own.

In the solutions to the mathematics poster problems we will often refer to Pascal's Triangle. Keep it handy!

---

continued from page 32

General Session: Lola May, Instructor

"I feel fortunate to be part of this experience." K.L.

"I'm a fan of hers forever!" A.W.

"Lola is just special. We love her." G.D.

"Can we please 'bottle' her energy? Get this on video tapes for districts." H.S.

"I just loved her. I got many excellent math ideas and activities for teaching math concepts." R.W.

"She takes the complex and simplifies it and makes it more teachable." L.B.

"She makes me feel proud to be a teacher." E.W.

All of this faculty will return for the 1987 Festival of Mathematics, June 22–July 3.

ORDER INFORMATION

Send all orders and remittances to:
AIMS Education Foundation
P.O. Box 7766 · Fresno, California 93747

The following are currently available:
Please order by book number **and** title.
Correlations to the California Science Framework Addendum for grades K through 9 are available for $9.

Grades 5-9 Series:

Book 1—Math•Science, A Solution	$10.95
Book 2—The Sky's the Limit	10.95
Book 3—From Head to Toe	10.95
Book 4—Fun With Foods	10.95
Book 5—Floaters and Sinkers	10.95
Book 6—Down to Earth	10.95
Book 7—Our Wonderful World	10.95
Book 8—Pieces & Patterns, Patchwk in Math & Sci	10.95
Book 9—Out of This World	10.95
Book 10-Probably So!	15.95

NOTICE:
—All California orders must add 6% sales tax.
—All orders will be charged a 10% shipping-handling fee.
—Schools may use purchase orders.
—Each book consists of Student and Teachers's Manual.

Grades K-4 Series:

K-1	Fall Into Math and Science, Bk. 1	$10.95
K-1	Glide Into Winter w/Math & Sci., Bk. 2	10.95
K-1	Spring Into Math and Science, Bk. 3	10.95
2	Seasoning Math & Sci.(Fall & Winter)	10.95
2	Seasoning Math & Sci.(Spr.-Summer)	10.95
3-4	Jaw Breakers and Heart Thumpers	10.95
3-4	Hardhatting in a Geo-World	10.95
3-4	Popping With Power	10.95
3-4	Overhead and Underfoot	10.95

Note: purchase of books entitles school to make 200 copies of student manual pages for classroom use.

Science Poster Series:

Set A	$10.95
Set B	10.95
Set C	10.95
Set D	10.95
Set E	10.95
Set F	10.95

Mathematics Posters Series:

Set A	$10.95
Set B	10.95
Set C	10.95
Set D	10.95
Set E (Available November, 1986)	10.95
Set F (Available September, 1986)	10.95

Project SETUP Books:

Rocky's Circuits	$10.95
The Golden Age of Exploration	10.95
Robot's Odyssey I	10.95
Sleuthing Across America	10.95

What Teachers Say...

The comments on this page were made in the evaluations submitted by participants in the 1986 Festival of Mathematics. This was the fifteenth the annual Festival offered by the Fresno Pacific College Math/Science Project. The Festival program features grade level sections and general sessions. The comments that follow refer to these sections.

K–1 Section: Valerie Welk, Instructor

"Well organized, excellent instruction, tons of information." N.B.

"Wonderful. This staff is just fantastic. Everyone I've come into contact with is so kind, accommodating, and generally super. I loved it!" S.G.

"Excellent job. The ones who organized this great event ought to be commended. It's fun to be around teachers like this for two weeks." N.M.

"I wish my kindergarten experience could have been with teacher like Valerie Welk!" C.F.

"Excellent! Great presenters, great food, great people!" S.P.

Grades 2–3 Section: Lawrence Ecklund, Instructor

"It is extremely well organized. I appreciated the congeniality of the staff members and their general overall concern for our comfort. There's nothing like it anywhere else." D.P.

"Very practical. Many great energetic teachers teaching great things that I unquestionably will use in my classroom." B.W.

"This Festival was great. I learned so much and my imagination started to grow by leaps and bounds. I got so many ideas of how to teach math." J.G.

"Can I come again next year?" M.M.

"I wish every teacher could have a chance to participate in this Festival!" J.L.

Grades 4–5 Section: Jonathan Knaupp, Instructor

"Super job! You created such a sense of community and great spirit. Excitement describes it all!" M.B.M.

"Great! I'm taking a lot back to the classroom, especially because of Dr. Knaupp's excellent presentations." E.S.

"Really excellent. I'm glad I came and will come again." M.F.L.

"Excellent. Nowhere could teacher and students of education get a better concept of math, ideas, hands-on activities, and problem solving techniques—great, great, great!" L.W.

"Very organized. Great instructors. Fun atmosphere." L.W.

Grades 5–6 Section: Judith Hillen, Instructor

"Each day of my teaching year will be enriched because of the Math Festival. I feel that I have grown as a person as well as a teacher." B.A.N.

"Judie was an inspiration!" K.G.

"One of the most fun and practical classes I have ever attended." D.W.

"Motivating experience, good investment of my time and energy." K.L.

"I feel that I learned many helpful things, got a lot of materials, and my teaching will improve greatly." J.M.

"I feel that my students will benifit greatly from my being here." L.T.

Grades 7–9 Section: Arthur Wiebe, Instructor

"I hope that I can use half of what I learned—it's almost overwhelming." M.S.

"I would return 'in a minute.' I only hope that I can use all this material in the next 2-3 years." L.B.

"This was a wonderful experience! I want to come back again next year." R.S.

"The many things I have learned will make me a highly effective teacher and will keep my classes from becoming 'boring old math'—fantastic!" G.S.

"Money and time well spent!" N.M.

"All the teachers are so friendly, helpful and interested in each of us." J.T.

High School Section: Stanley Bezuszka, Instructor

"A great place to learn and to get recharged." M.M.

"It is a good thing for teachers to come together to renew their spirit and to exchange ideas. Working with outstanding mathematics teachers, such as Stanley Bezuszka is a great experience." M.H.

"It is a great program." D.D.

"Good group, much interaction and stimulation." B.W.

"Very professional." D.O.

"Impressed by the caliber of the staff and their obviously genuine concern with the welfare of all the participants. A warm and friendly, but professional atmosphere." D.H.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

BULK RATE
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

100

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation

Volume 1, Number 4 November, 1986

Program for 1987 Science Festival Announced

The Second Annual Science Festival will offer an unusually rich and varied program of instruction, hands-on investigations, laboratory experiences, science software evaluation options and access to effective curriculum resources.

An outstanding faculty consisting of some of the nation's leading science educators will provide instruction in a broad range of topics selected from the biological, physical, and earth sciences. All presentations will be coordinated. The faculty represents a full range of expertise across the science education spectrum: authors, experienced workshop leaders, outstanding classroom teachers, and leaders in staff development.

Visiting scholars returning in response to widespread demand are Verne Rockcastle of Cornell University; Joe Abruscato of the University of Vermont; Del Alberti, Superintendent of Schools, Auburn; and Gilbert Yee of the Curriculum Implementation Center. Added to the faculty for this Festival is Dennis Schatz, Associate Director of the Pacific Science Center in Seattle, Washington.

Verne Rockcastle will draw upon a lifetime of experience in teaching science, conducting staff development programs, and authoring elementary and middle school science texts to share meaningful and practical activities that thousands of teachers have found helpful. He has a knack for being able to clarify some of the more difficult science concepts.

Joe Abruscato brings a strong emphasis on the integration of language arts with science and mathematics. Participants in the 1986 Science Festival gave high marks to this contribution and have incorporated this approach into their own teaching. This integration is exemplified in the context of hands-on activities throughout. He is the author of a current elementary science program.

Del Alberti, a much sought-after science workshop leader, makes a unique contribution from the perspective of a school administrator widely recognized for his leadership in curriculum implementation. In addition to his hands-on science presentations, he will share the carefully crafted program of implementation of a hands-on science program in his district.

Gilbert Yee draws from his years of experience as an exemplary classroom teacher to present stimulating activities in science. He has won many honors as a classroom teacher and participants soon recognize why as he leads them through hands-on activities.

Dennis Schatz will make a distinctive contribution in the area of astronomy in this, his first, participation in the Science Festival. He is highly regarded for the clarity of his presentations on the solar system, study of stars, and related topics. These activities will add a significant new dimension to the Science Festival.

Dennis Schatz is Associate Director of the Pacific Science Center in Seattle, Washington. He was Assistant Director of Astronomy Education at the Lawrence Hall of Science and moved to Seattle to start the Pacific Science Center's astronomy education program. He annually leads the Astronomical Society of the Pacific's teacher workshop and has offered astronomy education workshops for teachers across the United States.

(see Science Festival, page 5)

AIMS Announces Successful Launching of Trainers Program...

The directors of Project AIMS together with the respective school districts have carefully selected 73 teachers to participate in an in-depth training program in science and mathematics. These teachers will be thoroughly trained to effectively implement the 1984 California Science Framework Addendum and the 1985 Mathematics Framework in grades K–9 using the integrated mathematics-science approach of Project AIMS.

The initial phase of this two year program began with the 1986 Science Festival, July 14–26, 1986. During this two week period, these participants were taught and inspired by nationally recognized science educators including: Dr. Verne Rockcastle, Dr. Del Alberti, Gilbert Yee, Herb Strongin, Dr. Joe Abruscato, and Al Guenther. The program continues through the academic year on nine selected Saturdays where the trainers receive specially designed training in math and science content, processes, problem solving, and teaching methodologies. Most recently, these teacher trainers spent a full day with Mr. Wilbert Reimer, professor of mathematics at Fresno Pacific College, who shared unique insights and applications in problem solving and patterns in number, an approach that he has enhanced and refined after studying under Dr. George Polya at Stanford University. Other sessions include extensive hands-on activities with newly written AIMS experiences, including materials emerging from Project SETUP (Software Evaluation and Utilities Program) consisting of problem solving, simulation computer programs. The program content is driven by the Science Framework Addendum, Mathematics Framework, the physical science recommendations in the Model Curriculum Standards, and the rationale and content of the CAP tests. Each major topic will be covered by specific instruction and hands-on experiences. The overall approach will be in manner and language appropriate to the needs of elementary and

(see Trainers page 3)

IN SUMMARY

Gauss' Challenge

This month's mathematics poster deals with one of the helpful problem solving strategies that is credited to Gauss. **See instructions on Page 3 and the poster on Page 4.**

Puff Mobiles and Better Butter

This month's we feature the Porterville Public Schools and their program of integrating AIMS into the science curriculum. **Story on pages 6-7.**

Field Testers Invited to Apply

New AIMS investigations being written to current writing teams are ready for field testing. Field testers received a reduced tuition rate and materials for their participation. **Story on Page 8. Application form on Page 9.**

AIMS Education Foundation Receives Tax Exemption

The AIMS Education Foundation has been classified as tax exempt by the Internal Revenue Service. This opens the door for rapid growth through grants to support research, development, and dissemination of AIMS. **Story on Page 8.**

Model of Mathematics Continues to Grow in Significance

The third in a series on the Model of Mathematics developed by Dr. Arthur Wiebe appears in this issue. The December issue will continue with a discussion of "Connectors." A drawing suitable for making transparencies is found on Page 13. The Foundation has printed a 15x20 inch poster in color that features the same format. These may be ordered at $3.50 each postpaid or 5 for $10.95 postpaid. **Article on pages 10-13.**

Going Bananas

"Going Bananas" is a generalized investigation involving bananas that supplements one of the early AIMS investigations. It emphasizes estimation or "guessing and testing." On Page 16 is a revised form of the original AIMS investigation entitled "The Big Banana Peel!" It will be the practice of the Newsletter to update investigations through this publication to provide teachers who have pruchased earlier volumes with these revised materials. The new fact sheet on Bananas is shown on Pages 17-19. **The banana materials begin on page 14.**

Just Drop It!

The revision of this investigation appears in this issue. It is also discussed in the article on the Model of Mathematics. **See pages 20-21.**

The American and Russian Views

On Pages 22-25 is the first of two investigations that deal with an imaginary situation in which a space capsule is to be sent to a distant planet outside our solar system interpreting life in our world. It provides the opportunity to value factors in many disciplines. **We invite teachers to send in the form on Page 25 giving the results of their class. These will be tabulated and reported in a later issue of the Newsletter.**

A similar study was done in Russia in 1964. The questions used in that study will be printed in the December issue. The editors are soliciting a broad response to both investigations and will compare the American results with those we have obtained from Russia. **See pages 22-25.**

Let Me count the Ways

This new investigation written by Judith Hillen emphasizes guessing and testing. **See pages 26-30.**

Science Poster

This month's science poster is entitled "Floating and Sinking." The poster on page 32 should be duplicated with the mailing information deleted and then centered on the page. **Pages 31-32.**

☆ **AIMS** ☆ **NEWSLETTER** ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209) 291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. **Subscriptions** entered at any time of the year will include **all issues for that year**, August to May making available the **entire content of vital** articles and the thirty or more **new AIMS investigations and** twenty science and mathematics **posters. Second-class** postage paid at Fresno, California. **Address all correspondence** to **AIMS Newsletter**, P.O. Box 7766, **Fresno, California** 93727. Volume 1, No. 4.

EDITORS . . . . Arthur Wiebe, Judith Hillen
STAFF ARTIST . . . . Sheryl Mercier
OFFICE MANAGER . . . . Sheryl Bishop
PROGRAM DIRECTORS:
Fresno Pacific College Math/Science Project . . . . Lawrence E. Ecklund
AIMS Education Foundation . . . . Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes . . . Ted Ostrander
Project AIMS . . . . Judith Hillen, Arthur Wiebe
Project SETUP . . . . Jim Wilson, Ted Ostrander
Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION
PRESIDENT . . . . Arthur Wiebe, Ed.D.
VICE-PRESIDENT . . . . Wilbert Reimer
SECRETARY . . . . Lawrence Ecklund
TREASURER . . . . Jon Hillen
ACCOUNTANT . . . . Robert J. Dwyer
STAFF ARTIST . . . . Sheryl Mercier

(Trainers Program, continued)

middle school teachers taking into account possible knowledge deficiencies, fear of hands-on activities and divergent thinking, feelings of insecurity in math or science content and the need for realistic classroom management information and evaluation procedures.

The second year of this program is similar in nature but includes enrollment in the Summer 1987 Festival of Mathematics where again trainers will be exposed to nationally recognized mathematics educators such as Dr. Lola May, and Father Stanley Bezuszka of Boston College. The program culminates in an additional nine Saturdays of study during the 1987-8 academic year.

An essential and significant element of the Trainers Program is their concurrent program of instruction for local teachers. Each trainer is committed to providing 100 hours of instruction at the local school, district, or regional level within the two year framework. Listed here are the Trainers and their respective school districts.

Trainers of Teachers – Huntington Beach site

C. J. Anderson – Rialto Unified School District
Barbara Barlowe – Rialto Unified School District
Allan Brandt – Newhall Elementary School District
Rhoda Brassfield – Rialto Unified School District
Patricia Carey – Buena Park School District
Mary Cobb – Los Alamitos Unified School District
Julie Davies – Lompoc Unified School District
Jeff DeBeck – Coachella Valley Unified School District
David Fares – Clairbourn School, San Gabriel
Thad Francis – Hemet Unified School District
Kay Guth – Ontario-Montclair School District
Diane Hansen – Placentia Unified School District
Eileen Harrison – Pleasant Valley School District
Yuki Ihara – Los Angeles Unified School District
Joan Janis – Poway Unified School District
Kay Krausman – Fullerton Elementary School District
Marylou Miller – Fullerton Elementary School District
Barbara Morse – Pleasant Valley School District
Nancy Ortiz – Los Olivos Elementary School District
Wendy Patania – Hesperia School District
Janet Patti – San Ysidro School District
Geneva Pringle – Simi Valley Unified School District
Marylou Rankin – Tuscon, Arizona
John and Lois Strom–Desert Sands Unified School District
Brian Tash – Oceanside City Unified School District
Mary Zirm – Orcutt Union School District

Trainers of Teachers – Fresno site

Donna Battcher–Washoe County School District, Nevada
Stephanie Bothwell–Corcoran Jt. Unified School District
Skip Bullock – Oakhurst Union School District
Care Butler – Fresno Unified School District
Irma Colvin – Fresno Unified School District
Eleanor Cooper – Redwood City School District
Juliette Cowell – Alameda Unified School District
Wayne Dixon – Selma Unified School District
Patricia Faria – Alameda Unified School District
John Fowler – Taft City School District
Sandra Gilpin-Black – Fresno Unified School District
Julie Ginocchio – Walnut Creek School District
David Gonzalez – Fresno Unified School District
Doug Greene – Porterville Public Schools
Harriet Harris – Fresno Unified School District
Carol Kennedy – Fresno Unified School District
Jody Jones – Porterville Public Schools
Pat Keledjian– Fresno Unified School District
Pam Knecht – Beardsley Elementary School District
Valerie Lake – Sacramento City Unified School District
John Licursi – Gilroy Unified School District
Holland Locker – Fresno Unified School District
Gay'e Lowe – Fresno Unified School District
Carolee Maya – Gilroy Unified School District
LaNell McKay – Riverdale Jt. Union Elementary School District
Kathie Mittman – Porterville Public Schools
Sophia Muniz – Fresno Unified School District
Joanne Munson – Fresno Unified School District
Mary Nelsen – Oakhurst Union School District
Barbara Novelli – Pacific Grove Unified School District
Shelia Patterson – Tulare City Schools
JoAnn Philbrick – Bishop Union Elementary School District
Sherrin Pratt – Bishop Union Elementary School District
David Pribyl – Gilroy Unified School District
Betty Quarles – Fresno Unified School District
Estella Reyes – Fresno Unified School District
Laurel Robertson – Redwood City School District
Wendy Roberts-Worley – Central Union Elementary School Distric
Peggy Robinson – Fresno Unified School District
Pam Rubio – Gilroy Unified School District
Jim Sherblon – Lodi Unified School District
Esther Sluder – Earlimart School District
Gary Smoot – Fresno Unified School District
Patricia Stump – Lodi Unified School District
Linda Wiezorek – Lompoc Unified School District
Nikki Williamson – Fresno Unified School District

As announced in the August Newsletter, a new cadre of Trainers may enter the Program in the summer 1987. The Festivals of Science and Mathematics will remain a required component. The AIMS National Leadership Institute will be offered during two additional weeks during the summers 1987 and 1988 to replace the nine Saturdays during the academic years. Thus, a Trainer may complete the program in two consecutive summers. This allows teachers outside the state of California to consider this exciting opportunity. Applications and additional information regarding the Trainers of Teachers Program may be requested through:

AIMS Education Foundation
P.O. Box 7766
Fresno, CA 93747

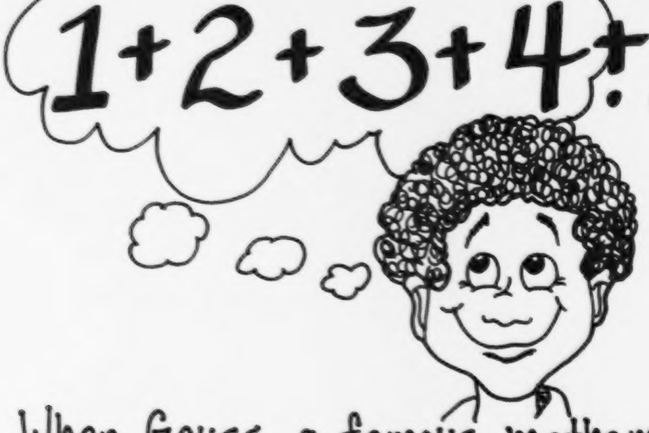
GAUSS'CHALLENGE

Solution:
The sums in the right column of the table are the triangular numbers. This discovery will allow students to continue the table indefinately. Note that the differences in these numbers are consecutive (2, 3, 4, 5, etc.).
The formula for the nth row is $n(n+1)/2$ (the value of the nth triangular number).

We note that the solution to Gauss' problem is 5050.

GAUSS' CHALLENGE

$$1+2+3+4+\ldots+100=?$$



When Gauss, a famous mathematician of the 18th century, was a young child in school, the schoolmaster one day gave the class the problem of finding the sum of the first 100 counting numbers. Gauss discovered an easy way to solve this problem and was the only one in the class to produce the correct answer!

Solve Gauss' problem by first finding the sum of the first counting number, then the sum of the first two counting numbers, then the sum of the first three etc. until you see the pattern that emerges. Record your results in a table like the one illustrated.

Number of Counting Numbers	Sum
1	1
2	3
3	___
4	___
5	___
6	___
7	___
8	___
9	___
. . .	. . . .
100	___
n	___

$1 = 1$

$1 + 2 = 3$

$1 + 2 + 3 = ?$

$1 + 2 + 3 + 4 = ?$

(Science Festival, continued)

Kim Sutton and Dave Youngs will teach the daily AIMS strands. Activities will include many that are currently being field-tested in preparation for publication. Both are members of the AIMS National Leadership Network, current classroom teachers, and much appreciated AIMS Workshop presenters. Kim Sutton was featured in the August issue of the AIMS Newsletter. Dave Youngs was a member of the original NSF funded AIMS Writing Project and has had extensive experience in presenting AIMS Workshops. These include those given in Africa during the two-year teaching assignment he has just completed on that continent.

A new feature of the 1987 Science Festival will be the daily laboratory sessions. Ted Ostrander of the Fresno Pacific College faculty will direct the laboratory option featuring scores of possible activities including construction of model rockets, simple electrical circuits, kites, wire geo-pane structures, kaleidoscopes, bird feeders, solar system measuring devices, posters and instructional materials, and various types of apparatus presented by the faculty.

Mike Woods will direct the second laboratory option that will concentrate on studies in biology, particularly those involving the use of a microsope. An inexpensive microscope well within the range of most schools will be used throughout to show the range of significant investigations that are possible. Mike is the author of a forthcoming AIMS publication dealing with topics appropriate for study with a microscope and he will share those activities in this lab. Another special feature of this lab will be the availability of state-of-the-art equipment for making video-tapes through the microscope or with the macroscope. High power microscopes and macroscopes will be used to produce tapes which will show subjects beyond the range possible with more inexpensive scopes.

Dr. Arthur Wiebe, Program Director of the Science Festival, demonstrates one of the new AIMS investigations.

The basic Festival fee is $340. Participants may also earn one of two types of credit: in-service or graduate. The additional fee for four semester units of in-service credit is $40. The added tuition fee for four semester units of graduate credit is $80. Graduate credit may be applied to the Master of Arts degree at Fresno Pacific College.

1987 SCIENCE FESTIVAL PRE-REGISTRATION

ALL information requested below must be supplied before this pre-registration can be processed. Full registration and housing information will be mailed upon such acceptance.

Name ______________________ Soc. Sec. No. ______________

Street ______________________ City ______________

State ______________ Zip ______________ Home Phone (______) ______________

School Address ______________________________

School Phone (______) ______________ I plan to register for: ☐ Graduate Credit

Do you plan to live on campus? ☐ In-Service Credit

☐ Yes ☐ No ☐ No Credit

Mail to: *Dr. Arthur Wiebe, Science Festival, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702.*

For Office Use Only

Date Received: ______________ Processed by: ______________

Copy to: ☐ Registrar ☐ In-Service ☐ Business Office ☐ Housing

Porterville students begin the design of their "Puff Mobile", an AIMS investigation dealing with wind power and vehicle design.

AIMS Activities Implemented in Porterville Public Schools

AIMS is alive and flourishing in Porterville Public Schools ! ! ! Doug Greene, District Science Resource Teacher, reports that Project AIMS is being implemented there in a variety of ways. Kindergarten teachers desired a hands-on science program that focused on process skills. They also wanted a program that naturally integrated many disciplines without costly materials and endless preparation. AIMS activities are meeting those objectives.

Doug continues, "In grades one through six, the AIMS program has been adopted as a supplement to our district adopted science text. Currently we are in the process of assigning grade levels to specific AIMS activities and then will provide complete sets of AIMS materials to all grade levels."

An important aspect of the program is to provide regular in-services to all of the teachers at the seven elementary schools in the district. Introductory, awareness types of workshops were held in the Spring, 1986 at three elementary schools: West Putnam, Vandalia, and Westfield. Judie Hillen, Project AIMS Director, led those initial full-day workshops. The response of teachers was so encouraging that three teachers enrolled in the Trainers of Teachers Program in Fresno and have now begun to continue the in-servicing at the local level. These trainers are Jody Jones, second grade teacher at Roche School, Kathie Mittman, sixth grade teacher at West Putnam School, and Doug Greene, Science Rescource Teacher. They will continue to be involved in intensive study for a period of two years and concurrently offer in-services at the local level. During the month of October, this team offered an In-Service course to teachers called The Magic of AIMS at Roche School. They presented nearly 40 hands-on activities including By Golly, By Gum, Jelly Bellys and Screen Test to name a few. Teachers then returned to their classrooms to try several activities and met again to share their experiences. In-services of this nature will continue to be offered by this team.

This four member team is confident of the quality of its Puff Mobile design.

The district has taken another major step by recently hiring a science teaching team composed of Steve Reynolds and Mike Martinez, to present hands-on types of activities weekly to all fourth, fifth, and sixth grade students. They, too, will be making the best use of AIMS activities.

According to Doug, perhaps one of the greatest rewards has been the renewed commitment and excitement on

The real test takes place in this outdoor people-puffed wind tunnel. Both the design and the lung power are crucial.

the part of teachers and students towards science, as is evidenced by these comments following AIMS workshops conducted by their trainers...

"AIMS has been an enrichment experience that is truly motivating."

"The AIMS project is great for all grades and is interesting for all ages."

"The AIMS program is the demystification of math."

"AIMS fosters creativity and divergent thinking."

"The best teacher is experience itself. My primary job as an educator is to be a motivator of learning. I was timid to teach science, not being of a mathematical mind. The AIMS project destroys common misconceptions of science being abstract. The food, manipulations and integrating of all senses excites the children. No memorization. . . all experience!"

"AIMS is excellent for bi-lingual classrooms. It allows students to experience math and science."

"Through AIMS students learn the practical uses of math—that math is more than just numbers in a book.

The class is discussing the outcome of the "Better Butter" AIMS investigation. The results have been charted on the graph.

The "Better Butter" experiment involves everyone in the task of making butter.

AIMS Education Foundation Granted Tax Exempt Status

The Internal Revenue Service has notified the AIMS education Foundation that it has been granted tax-exempt status under Section 501 (c)(3) of the Internal Revenue Code. The State of California had previously taken similar action.

The Foundation was incorporated on June 18, 1986 as a non-profit corporation in the State of California to carry on a broad range of educational activities associated with AIMS on the national level.

The letter states in part that "we have determined you are exempt from Federal income tax under section 501 (c)(3) of the Internal Revenue Code. . . Donors may deduct contributions to you as provided in section 170 of the Code. Bequests, Lagacies, Devises, transfers, or gifts to you or for your use are deductible for Federal estate and gift tax purposes if they meet the applicable provisions."

The Foundation is receiving strong support from educators and the larger educational community. The tax-exempt status will strengthen the Foundation's program of research and development, teacher training, and publication. Donations will be sought from individuals, corporations, and foundations.

Donors may select from the following categories if they wish to designate the program they wish to support: general support, endowment fund, or research and development. The endowment fund will build a strong base of support for long-range programs. Research and development funds will be used for more immediate programs. General contributions will be used to support the overall program of the Foundation.

All correspondence with respect to contributions should be addressed to: Director of Advancement, AIMS Education Foundation, P. O. Box 7766, Fresno, California 93747.

What Teachers Say...

The comments on this page were made in the evaluations submitted by participants in the Summer 1986 AIMS Workshops. Participants attended general sessions in the morning and focused on grade level strands in the afternoons.

"This has been the best workshop I've ever attended!"

"I'm inspired and excited to get started in the fall."

"Fantastic!! I truly enjoyed the hands-on experience."

"This is my second experience with AIMS. I'm just as enthusiastic and pleased with this curriculum as last year. The lessons are the best I've ever done for kids in mathematics and science. They loved it too."

"It was a great week. Instructors were excellent—abundance of materials and a great group of people."

"Well organized! A multitude of excellent ideas! I would recommend it for all teachers and those preparing to be teachers."

"All things you are doing demonstrate a genuine interest in our learning."

"The concept of AIMS is fantastic and essential."

"AIMS is excellent for the bi-lingual classroom."

"AIMS emphasizes the philosophy of problem solving and challenged me to do non-structured thinking."

"It is a pleasure to be taught by knowledgable people who are in tune with what is going on in the classroom and who are sympathetic to the things we face in the real world."

"It was truly an up-dating and an up-grading experience."

"Excellent presentations! Good background information and great ideas to integrate math and science and language."

"Wonderful, wonderful week."

"I wish all teachers could have had this experience."

AIMS Invites Teachers to Field Test New Activities

Be among a fascinating group of eager teachers who are ready to field test newly written, unpublished AIMS activities in their classrooms.

AIMS directors are now accepting up to 100 classroom teachers in grades 4–9 for field testing activities to begin in January, 1987 at two sites—Fresno and Huntington Beach. Fifty participants will be selected at each site.

Qualified participants may earn 2 semester units of In-Service credit at $30/unit through Fresno Pacific College. Classes will be held from 8:00–12:30 on seven selected Saturday mornings. Specific dates for each site are listed.

Fresno Pacific College Fresno	College View School Huntington Beach
Jan. 24	Jan. 10, 31
Feb. 21	Feb. 28
Mar. 14	Mar. 21
Apr. 4, 25	Apr. 11
May 16	May 9
June 6	May 30

Requirements include attendance at all sessions, and classroom field testing and evaluation of 15 activities. Participating teachers will receive two Project AIMS publications of their choice.

Field Testing Application

FIELD TESTING APPLICATION

Name ______________________________ Soc. Sec. No. ______________

Address ____

______________________________ Phone ______________

School District ______________________________________

School ______________________________ Phone ______________

Grade Level Assignment ______________________________

Please complete the following:
1. Are you new to hands-on types of activites such as AIMS? ☐ Yes ☐ No
or
Are you currently using these kinds of activites in your classroom? ☐ Yes ☐ No
If yes: Describe briefly how you are implementing the activities into the curriculum.

____

____

____

____

2. Describe the degree of support your administration might offer regarding the testing of integrated math-science activities in your classroom.

____

____

____

____

3. Briefly describe why you think being a part of the AIMS Field Testing Team will be mutually beneficial for both parties.

____

____

____

____

Please direct applications or requests for further information to:
Judith Hillen, Project AIMS Director
Fresno Pacific College
1717 S. Chestnut Ave.
Fresno, CA 93702

A Model of Mathematics

Dr. Arthur J. Wiebe

(Ed. Note: This the third in a series on the Model of Mathematics begun in the September issue of the AIMS Newsletter.)

We have examined the meaning of each of the four symbols in the Model of Mathematics and of the movements from one to any of the others in detail. We turn our attention to the task of constructing lessons that utilize the Model to give maximum meaning to the mathematics experience.

Our first goal is to provide as many mathematics experiences as possible that utilize all four forms contained in the Model with a maximum number of moves among the forms.

Just as motels are given two-star or four-star ratings, for example, we will give such ratings to the lessons in mathematics. Each move from one form to another will raise the level by one"star". Stated in these terms, we will set as our goal the creation of as many four-star and five-star lessons as possible; and to limit the use of zero-star and one-star lessons to appropriate situations.

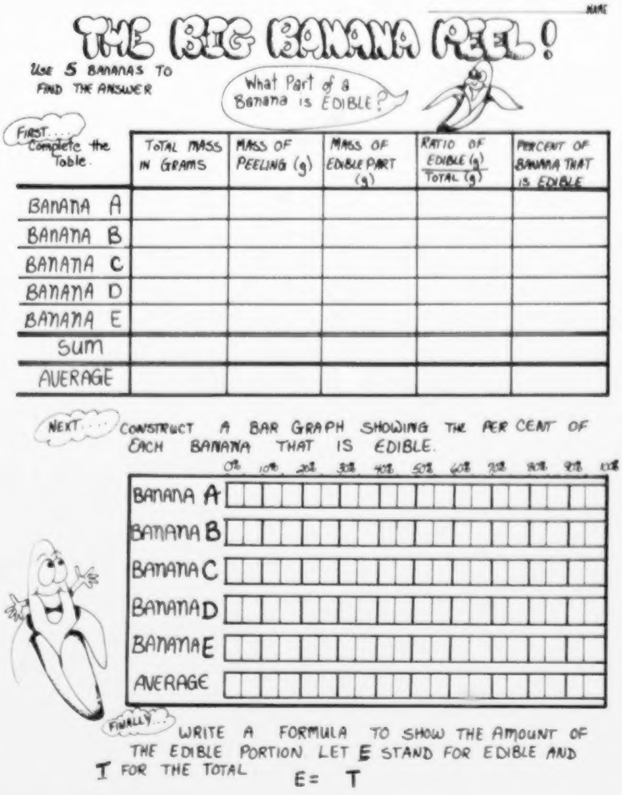
Much of mathematics instruction in America consists of memorization and drill activities. Some of this is important. If carefully selected and appropriately used it forms the firm foundation for the real study of mathematics. In future articles, building this firm foundation will be examined. However, when matched against the Model, such activity must be given a "zero-star" rating. It is preparation for the study of mathematics but not an end in itself. Only as it leads to problem solving at the earliest possible moment does it further the student's experience in mathematics.

Our second goal is to teach the Model to students and have them plot any given lesson onto the forms and movements in the Model. Only then will students really understand the study of mathematics.

The best way to arrive at these goals is to examine a **five-star lesson.** What is such an experience like? What is involved?

Below is such an AIMS lesson entitled "The Big Banana Peel." It is such a friendly lesson that it even has the bananas smiling. Classroom testing shows that it causes children to smile too as they go through a genuinely mathematical experience.

The activity begins by asking students to make a guess. Dr. George Polya, father of the problem solving movement in the United States, defined the process of science as "guess and test." If we are to teach science we must help our students to become intelligent guessers. They can do so only if we provide an abundance of meaningful guessing opportunities. That is why AIMS activities generally begin with a "key question."



NAME

THE BIG BANANA PEEL!

USE 5 BANANAS TO FIND THE ANSWER

What Part of a Banana is EDIBLE?

FIRST.... Complete the Table.

	TOTAL MASS IN GRAMS	MASS OF PEELING (g)	MASS OF EDIBLE PART (g)	RATIO OF EDIBLE (g) / TOTAL (g)	PERCENT OF BANANA THAT IS EDIBLE
BANANA A					
BANANA B					
BANANA C					
BANANA D					
BANANA E					
SUM					
AVERAGE					

NEXT.... CONSTRUCT A BAR GRAPH SHOWING THE PER CENT OF EACH BANANA THAT IS EDIBLE.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

BANANA A

BANANA B

BANANA C

BANANA D

BANANA E

AVERAGE

FINALLY... WRITE A FORMULA TO SHOW THE AMOUNT OF THE EDIBLE PORTION LET E STAND FOR EDIBLE AND T FOR THE TOTAL

E= T

If the guess is based on simple reasoning, the student begins at the triangle level. If the guess requires more complex reasoning such as processing various types of information in order to formulate the guess,the start is at the hexagon level. The distinction is arbitrary, to be sure, but useful. We want students to use more and more complex reasoning as a basis for making a guess or stating a hypothesis.

The guess to be made here is in response to the key question: What percent of the mass of the banana is edible? The edible portion must be defined. Here, it is the pulp, the part the monkey eats.

The second step is to find the mass of the banana, its edible part, and its skin. As the students engage in this activitiy, the movement is from the triangle to the circle; from the guess to testing it in the three-dimensional world. **This move raises the activity to the one-star level.**

Each cooperative group of students receives a banana to be tested. The three different massings are completed and recorded. It is important to make three massings rather than two in which case the mass of the peeling would be substracted from the total to obtain the mass of the edible portion. By completing three massings, students have more experience using the scales and it provides the opportunity for checking the accuracy. Note that the sum of the masses in the second and third columns should approximate the mass in the first. Approximate? Yes! Measurement is always approximate and the sum may differ by one gram from the mass in the first column since we are massing to the nearest gram and therefore rounding off. Students here have a realistic experience with the fact that measurement is only approximate. In the event that the difference is greater than one (or at the most two) students need to stop and engage in trouble-shooting. Why did the discrepancy occur? Tracing the cause of such a discrepancy is an important part of "doing the work of the scientist." Was the error caused by taking readings improperly? Was it beacuse the the scales were not working properly? Was it because some of the masses were not accurate? All of these and others have occurred.

Trouble-shooting situations should always be welcomed and utilized to the fullest. We should never abort this part of the experience.

Next, the information is entered into the table. This moves the activity from the circle to the triangle. **This is the second move and raises the investigation to the two-star level.** Entering information into tables and reading information from tables is a basic mathematics skill that finds many applications in real life.

After each of the groups have made these measurements, the information in the first three columns only is exchanged. Note: no computed results are exchanged, only the raw data. Therefore, each group makes all of the computations. This provides maximum practice in the skills involved. Often students will make many such computations in an AIMS investigation and then comment that they "are glad we didn't have math today." Notice the variety of mathematics skills that are involved in these computations: writing ratios, finding percent, and computing averages. With such lessons, students frequently find thay have to call upon a broad range of mathematical skills, just as in real life. Textbook treatment is normally sequential and when one topic has been taught another is introduced but they rarely ever get together for a reunion!

After the average percentage has been computed, students construct the bar graph, one of the large family of graphs incorporated into AIMS investigations. The graph is a form of visual shorthand that provides a quick and accurate picture of given situation. Graphing is the third movement, this time from the triangle (in the form of the table of information) to the square. **Graphing raises this activity to the three-star level.**

Now students are asked to write a formula relating the mass of the edible portion, E, to the total mass of the banana, T. Students may reason that the coefficient of the T must be less than one since the edible portions has a mass less than the total. The best information about this group of bananas is given by the average percentage. **The function of an average is to help guard against significant error.**

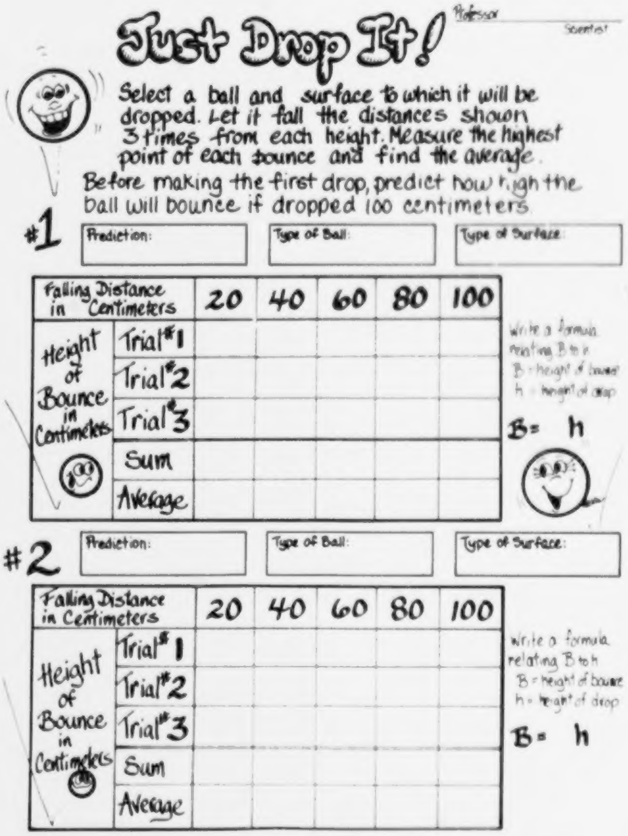
In this case, the average will be in the neighborhood of 65%, depending upon the ripeness of the banana. Assuming this figure, how are we going to write it? We don't use percentages in such formulas so 65% is not an appropriate form. It must be converted to a decimal: .65. The formula becomes E = .65T. Writing the formula based on the computed average in the table is the movement from the triangle to the hexagon in the Model. **This fourth movement raises the activity to the four-star level.**

But, is the information of practical use? Certainly! As the student passes bananas in the fruit section of the grocery store he can say, "Aha! I know something about you! About 65% of you is edible and the rest is waste." **Such an application is a fifth movement and raises the experience to the five-star level.**

This information is of practical importance. How much is the customer paying per pound for what is consumable? If bananas are priced at 30 cents per pound, the cost of a pound of edible portions is actually 45 cents using these results. One-third of the money is wasted on the skin that is thrown away. This is helpful consumer education.

It is interesting to note that the percentage found in this investigation may be used as readily with pounds as with grams. **Percentage is a universal language!** In one moment it is used in the metric system and in another in the standard system. It is no respecter of the type of system used!

It is instructive to examine a second example. Bouncing balls permeate the experience of children and are the focus of the next AIMS investigation entitled "Just Drop It." In it, students will attempt to learn something about how a ball behaves when it bounces.



Just Drop It!

Professor ______
Scientist

Select a ball and surface to which it will be dropped. Let it fall the distances shown 3 times from each height. Measure the highest point of each bounce and find the average.

Before making the first drop, predict how high the ball will bounce if dropped 100 centimeters.

#1

Prediction: ______
Type of Ball: ______
Type of Surface: ______

Falling Distance in Centimeters		20	40	60	80	100
Height of Bounce in Centimeters	Trial#1					
	Trial#2					
	Trial#3					
	Sum					
	Average					

Write a formula relating B to h
B = height of bounce
h = height of drop

B = h

#2

Prediction: ______
Type of Ball: ______
Type of Surface: ______

Falling Distance in Centimeters		20	40	60	80	100
Height of Bounce in Centimeters	Trial#1					
	Trial#2					
	Trial#3					
	Sum					
	Average					

Write a formula relating B to h
B = height of bounce
h = height of drop

B = h

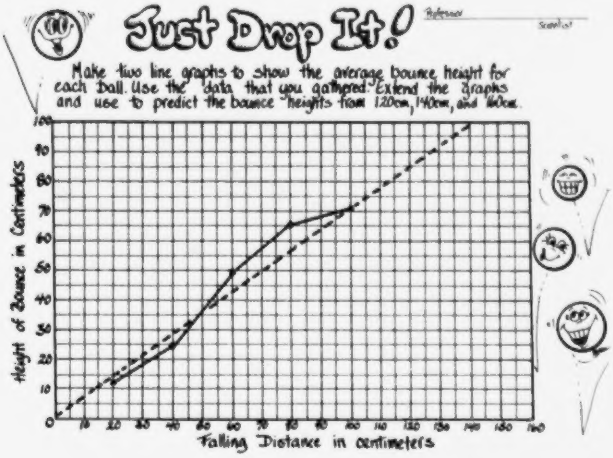
The investigation begins by determining the variables to be controlled: the type of ball and the type of surface to which it will be dropped. The variable to be tested is the effect height of drop has on the height of the bounce.

At the outset, the student is asked to make a prediction in response to the key question: How high will the ball bounce on the selected surface if dropped from a height of 100 centimeters? After the prediction has been made, a triangle activity, the test in the real world begins. **This**

movement makes it a one-star activity.

Students will drop the ball from five heights: 20, 40, 60, 80, and 100 centimeters. (Most students find it easiest to read the height of the bounce from the 100 centimeter drop and therefore begin with that height.) The measurement skill involved is a sophisticated one: reading the height of the bounce just at the instant it peaks. Several practice trials are recommended. This type of measurment is far more sophisticated than that of finding the dimension of a book, for example. The latter can be delayed and returned to at any time. It can be rechecked as often as necessary. On the other hand, the bounce of a ball occurs once and only once and then is gone forever. Further, it is at the top of the bounce for only an instant, requiring a rapid reading made as accurately as possible.

The results from three trials for each height of drop are recorded in the table, moving the activity from the circle to the triangle. **The activity is now at the two-star stage.** Averages are computed and then the points are graphed and joined by a broken line graph, a sample of which is shown below. **This moves the activity from the triangle to the square and it reaches the three-star stage.**



Next, students are asked to write a formula. The simplest way to do this is to take the average result from the drop that gave the best results, as decided by the students. Usually, this is the 100 centimeter drop since the percentage of error is likely to be the least. In this case, the average height of the bounce was 72 centimeters or 72% of the drop. Therefore, the formula relating B (height of bounce) to h (the height of drop) is $B = .72h$. The movement has been from the square to the hexagon. **The activity has attained the four-star stage.**

Can the formula be used to make a prediction for the untested drop of 120 centimeters? Certainly. $B = .72(120) = 86.4$ cm. Will that be the actual result? Such a test of a prediction based on experimental evidence moves the activity from the hexagon to the circle. **This application and test moves the activity to the five-star level.** "Just Drop It" is another five-star activity!

A broken line graph is complex. It provides us with a number of opportunities for analysis.

It is important that students learn the following about broken line graphs.

a. The horizontal axis is always used to chart the **independent** variable. This is the variable the student controls. It is also known as the **manipulated** variable. The description that is probably the most meaningful to students is that it is the **"I'm in charge"** axis.

The vertical axis is always used for the **dependent** or **resulting** variable. Students like to call it the **"Nature's in charge"** axis.

b. In a broken line graph that appears to have some regularity that suggests a straight line, we like to draw the best straight line that matches an "average" set of results. **If the results of an investigation plot as a straight line or an approximation of a straight line, we know that we have found a rule or formula. Therefore, a straight line on such a graph marks an important discovery.**

If the results suggest a straight line, students need to consider other question: "What does the point O,O mean in this situation? Would the line pass through the point O,O in this investigation?" This point means: no drop, no bounce. Therefore, the line would pass through this point. This conclusion is arrived at not by investigation but by logical reasoning. We now have one firm "anchor" for the line.

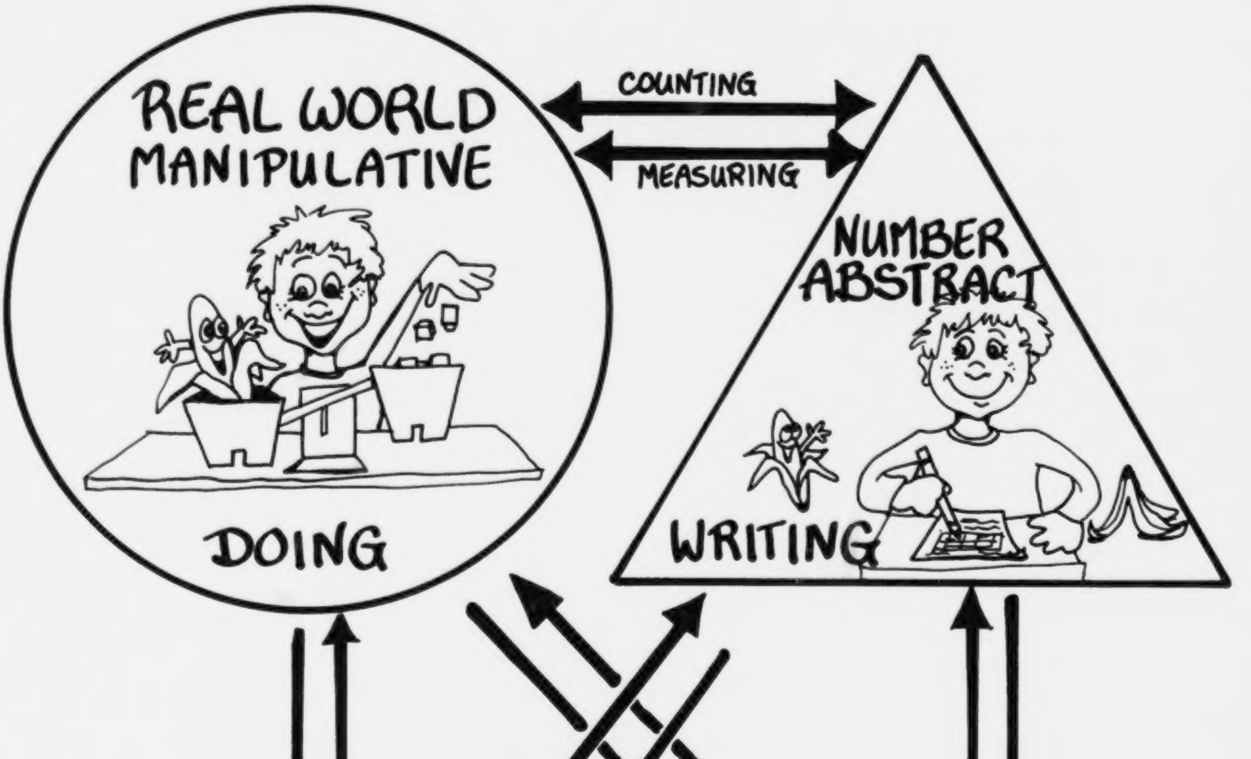
Since two points determine a straight line, we must now find that second point. If the bounce from the 100 centimeter drop is considered the best experimental result we use that point. A straight line from the origin to the height of the bounce from the 100 centimeter drop would be the most accurate description of how the ball bounced in our investigation.

c. This line can used to make the prediction for untested heights of drops by extending it through such heights on the graph. Then, the resulting bounce can be read and the test results compared to the predicted results.

d. Students can also check to see which results differed most from this straight line. This tells where they may want to repeat the tests to determine whether other and better results can be obtained. Thus, a single plotted point on the graph, tiny as it is, says to the student: "Make this test again. I believe you can get better results!" It is not remarkable that a tiny point on a graph can give such a detailed message of how to improve the investigation by performing a complex act in the real world? Such is the nature of graphs. They convey significant messages in a very efficient manner. When students understand these fine points about such a graph which arises from a real world experience thay have truly established a relationship and a conversation with the graph. First, the students spoke to the graph in constructing it: "This is what you should look like." Second, the graph replies: "If you want to improve your results, do this part of the investigation again." **Students and graphs should talk to each other in this way.**

In the next issue we will look at the evaluation of student learning from the standpoint of the comprehensive view of mathematics offered by the Model of Mathematics. This is much more extensive and complex than measuring the memorization of facts and algorithms.

A MODEL OF MATHEMATICS



GOING BANANAS

I. Topic Area:

Estimation and Measurement

II. Introductory Statement:

Students will make predictions and estimates relating to bananas and check them by testing and measuring.

III. Math Skills	Science Processes
a. Estimation	a. Estimation
b. Measuring mass	b. Measuring mass and length
c. Measuring length	c. Predicting
d. Computing percentages	d. Drawing conclusions
e. Cumputing percent of error	e. Formulating hypothesis

IV. Materials

Student worksheets
Scales and masses
Metric rulers or tapes
Bananas, one for each student group

V. Key Questions

a. Will the whole banana, the pulp, or the peeling of a banana float or sink?
b. What percent of the banana is edible as ordinarily understood?

VI. Background Information

In the age of hand-held calculators and computers, the skill of estimation is crucial. In this activity students will refine their concepts of metric lengths and masses by "guessing and testsing."

Bananas that are ripe will have a higher percentage of edible than those that are green. The size of the banana generally has little effect on the percent that is edible.

VII. Management

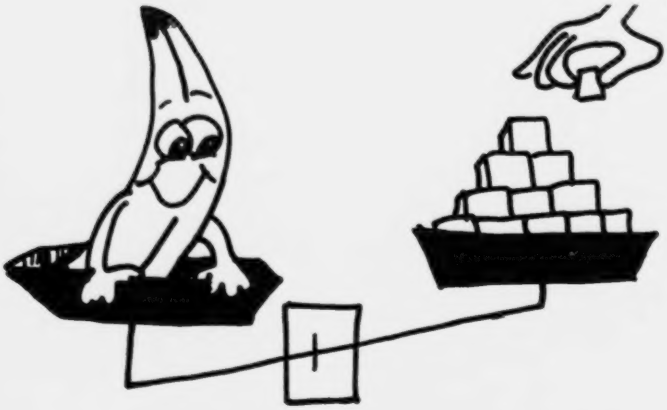
1. This activity, including the computation and excepting questions 7 and 8 will take about one class period of 40 minutes.
2. If questions 7 and 8 are to be tested at the same time, bananas at various stages of ripeness with other factors controlled should be available.
3. Students should first make individual predictions and guesses and then work in cooperative learning groups to discuss those predictions. A concensus need not result but the discussion should sharpen the focus on the estimation.
4. After students have tested their predictions and computed the percent of error, discussion on the process and refinement of guesses should be discussed.

VIII. Procedure

1. Students will make their individual predictions.
2. Students will discuss their predictions in small groups and may change their individual predictions.
3. Students will measure and test to obtain the experimental results.
4. Students will determine their percent of error by dividing the difference between the guess and the actual by the actual.
5. The class will discuss methods of refining such guesses.
6. The class will formulate hypothesis as in questions 7 and 8.

IX. Extensions

1. The percent of edible in various types of bananas and conditions of ripeness will be explored.
2. The percent of waste in other fruits will be examined.



MODEL OF MATHEMATICS POSTER AVAILABLE

A four-color, 15"x20" poster of the Model of Mathematics suitable for classroom display is now available for $3.75. A set of five posters sent to the same address is $10.95 postpaid.

These posters are excellent instructional tools for helping students to understand the nature of mathematical studies.

Posters may be ordered from the AIMS Education Foundation.

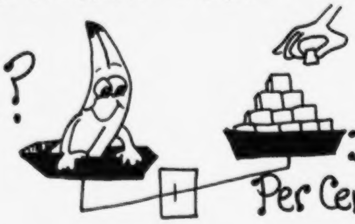
Going Bananas

Name ______________________

For each of the following, give your estimate or best judgment. Then, apply the test to the banana or bananas you are examining. Determine the per cent of error by dividing the difference by the actual.

	Prediction	Test Result
1. Will the whole banana sink or float?	______	______
2. Will the pulp (peeled) of the banana sink or float?	______	______
3. Will the peeling of the banana sink or float?	______	______

4. What is the mass of the banana in grams?



Guess: _____ grams
Actual: _____ grams
Difference: _____ grams
Per Cent of Error _____ %

5. What is the length of the banana in centimeters?

Guess: _____ cm
Actual: _____ cm
Difference: _____ cm
Per Cent of Error: _____ %

6. Considering mass, what per cent of the banana is edible (pulp)?

Guess: _____ %
Actual: _____ %
Difference: _____ %

7. Considering mass, does the ripeness of the banana make a difference? State your hypothesis and explain how you would test your hypothesis.

____

____

8. Considering mass does the per cent that is edible change with the size of the banana? State your hypothesis, test it, and report the results.

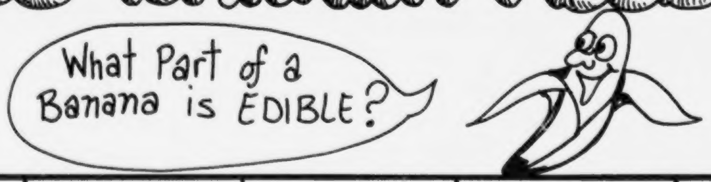
____

____

____________________ NAME

THE BIG BANANA PEEL!

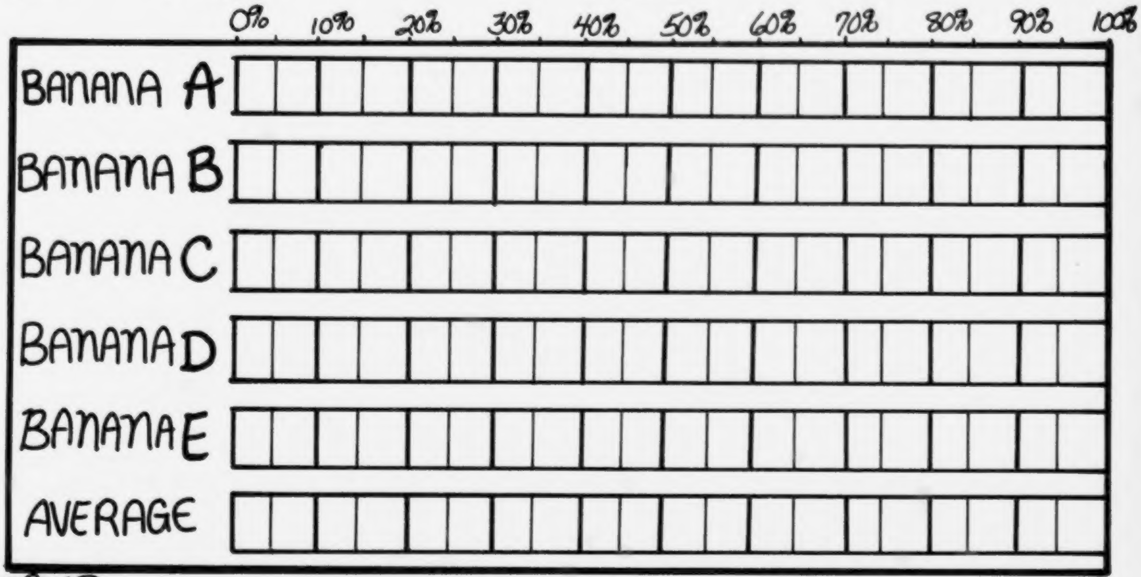
USE 5 BANANAS TO FIND THE ANSWER


What Part of a Banana is EDIBLE?

FIRST.... Complete the Table.

	TOTAL MASS IN GRAMS	MASS OF PEELING (g)	MASS OF EDIBLE PART (g)	RATIO OF EDIBLE (g) / TOTAL (g)	PERCENT OF BANANA THAT IS EDIBLE
BANANA A					
BANANA B					
BANANA C					
BANANA D					
BANANA E					
SUM					
AVERAGE					

NEXT.... CONSTRUCT A BAR GRAPH SHOWING THE PER CENT OF EACH BANANA THAT IS EDIBLE.



FINALLY... WRITE A FORMULA TO SHOW THE AMOUNT OF THE EDIBLE PORTION. LET E STAND FOR EDIBLE AND T FOR THE TOTAL.

E = T

THE TRUTH ABOUT BANANAS

Scientific Name Family: Musa Sapientum
(our common banana)
Genus: Musa
Species: Paradisica
Food Value Water: 75.3%
Carbohydrates: 22%
Protein: 1.3%
Ash: 0.8%
Fat: 0.6%

Which of these statements do you think are true?

a. The banana is a berry.
b. Bananas grow on trees.
c. Pound-for pound, bananas are the most widely sold fruit in the United States.
d. Bananas are highly nutritious and easily digested.

THE BANANA PLANT

You may be surprised to learn that bananas are berries! A berry is a simple fruit having a skin surrounding one or more seeds in a fleshy pulp. Botanists classify grapes, tomatoes, currants, and bananas as berries.

Bananas grow on a tropical plant that is not a tree, because it has no trunk, but a gigantic herb that springs from an underground stem. What appears to be the trunk is a false stem formed by tightly wrapped leaf-sheaths that grows to a height of 3 or more meters. From the top, ten to twenty large oblong to elliptical leaves fan out. It takes 15–18 months to grow the one stalk of bananas it bears. Bananas on the stalk point upward. After harvesting, the plant is cut down and the underground rootstock produces new shoots for the next plant. There are over 100 varieties of bananas.

THE BANANA AS FOOD

Pound for pound, bananas are the most widely sold fruit in the United States. They are the most important of all commercial fruits, close to the combined production of all citrus fruits.

Bananas are an excellent food source of potassium, vitamins A and C, and quick energy. They are low in protein and fat. They are an excellent between meal snack and one of the most easily digested and nutritious natural foods. A medium size banana has about 125-130 calories, or about one calorie per gram.

Bananas come with their own wrapping, ready to go into lunch boxes. They are tasty sliced on breakfast cereals, in fruit salads, and gelatin desserts. An easy to make banana shake consists of one whole peeled banana and a cup of milk mixed to smoothness in a blender. A raw egg and a little nutmeg may be added for taste. Bananas are recommended for low-fat, low sodium diets. The banana is at its best eating condition when the bright yellow peeling is flecked with brown speeks, Known as "sugar specks."

Plantains, a cooking variety of bananas larger than our common banana, is a staple food in the tropics. They are starchy when green. Plantains take the place of potatoes. Plantain chips are the Latin America equivalent of our potato chips!

Bananas are used in the preparation of flavorings. Vacuum dehydration yields banana crystals, a light-brown powder used in ice cream, bakery products and milk-based beverages.

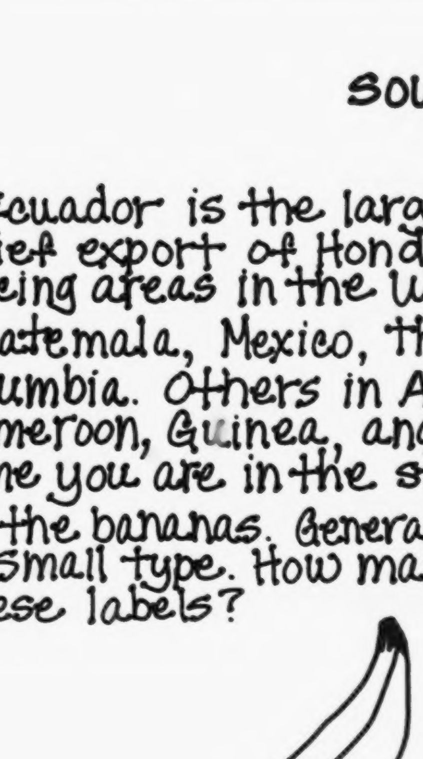
"Tree-ripened" would not make good advertising for bananas. If allowed to ripen on trees they are starchy, mealy, or rotten and therefore inedible. They arrive on the market dead green and are ripened in air-tight rooms with controlled humidity and temperature. These conditions permit nearly all of the starch to be converted into sugar for good tests. The best condition in which to buy bananas is when they are bright yellow with a green tip. Look for plump, well-filled fruit.

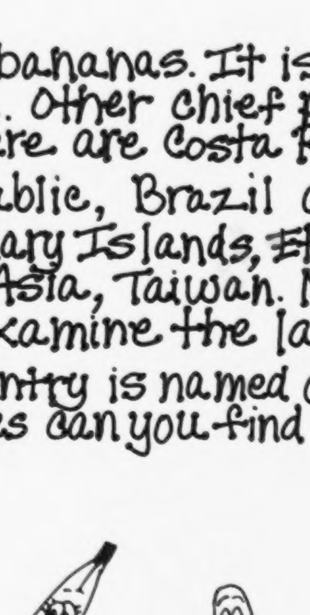
HISTORY OF BANANAS

It is generally agreed that the banana originated in Malaysia and the East Indies. It is frequently referred to in ancient Hindu, Chinese, Greek and Roman literature and in sacred texts of Oriental cultures. It is said that the armies of Alexander the Great fighting in India were the first Europeans to learn about bananas. Theophrastus, in a book written in the 4th century B.C. and considered to be the first scientific botanical work known, described the banana. The Arabs introduced them to the Near East and Mediterranean. They came to the Caribbean Islands and Mexico shortly after Columbus' Voyages. The botanical name, Musa Sapientum, means "fruit of the Wise Men." This name derives from the legend that sages in India sat under banana trees during times of meditation. Today wise men, women, boys, and girls eat bananas because they are such an excellent and nutritious food.

SOURCES OF SUPPLY

Ecuador is the largest exporter of bananas. It is the chief export of Honduras and Panama. Other chief producing areas in the Western Hemisphere are Costa Rica, Guatemala, Mexico, the Dominican Republic, Brazil and Columbia. Others in Africa are the Canary Islands, Ethiopia, Cameroon, Guinea, and Nigeria and in Asia, Taiwan. Next time you are in the store carefully examine the label on the bananas. Generally, the source country is named on it in small type. How many source countries can you find on these labels?





Professor: ____________________
Scientist

Just Drop It!

Select a ball and surface to which it will be dropped. Let it fall the distances shown 3 times from each height. Measure the highest point of each bounce and find the average.

Before making the first drop, predict how high the ball will bounce if dropped 100 centimeters.

#1

Prediction:

Type of Ball:

Type of Surface:

Falling Distance in Centimeters		20	40	60	80	100
Height of Bounce in Centimeters	Trial #1					
	Trial #2					
	Trial #3					
	Sum					
	Average					

Write a formula relating B to h.
B = height of bounce
h = height of drop

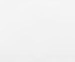
B= h

#2

Prediction:

Type of Ball:

Type of Surface:

Falling Distance in Centimeters		20	40	60	80	100
Height of Bounce in Centimeters 	Trial #1					
	Trial #2					
	Trial #3					
	Sum					
	Average					

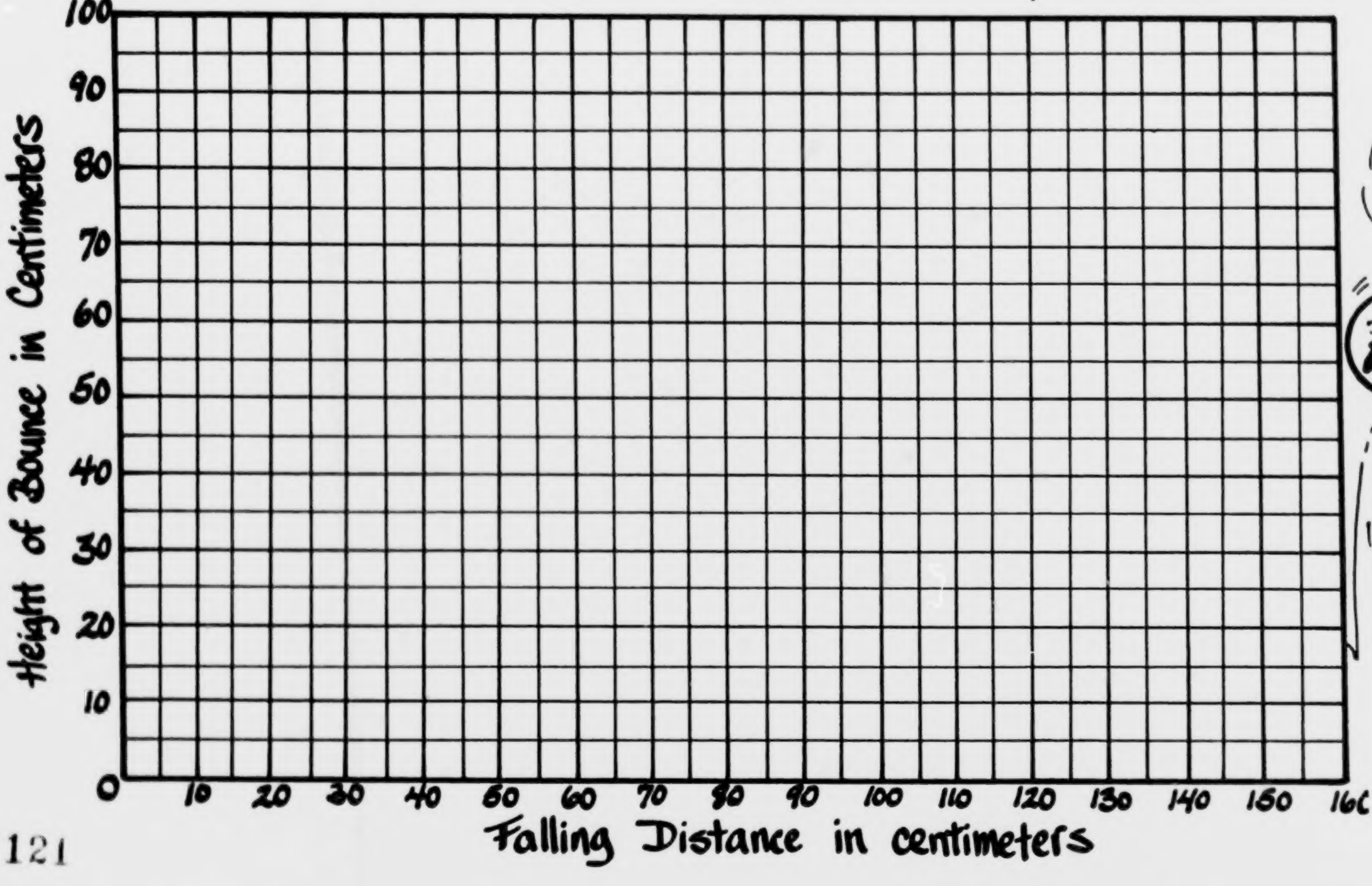
Write a formula relating B to h
B = height of bounce
h = height of drop

B= h

Just Drop It!

Professor: ______________________
Scientist

Make two line graphs to show the average bounce height for each ball. Use the data that you gathered. Extend the graphs and use to predict the bounce heights from 120cm, 140cm, and 160cm.



Space Capsule

I. Topic Area

Time capsule for space

II. Introductory Statement

Students will determine what items they would send in a time capsule to extra-terrestrial life on another planet.

III. Math Skills

a. Conducting a survey
b. Sorting
c. Problem Solving
d. Graphing

Science Processes

a. Collection and recording data
b. Interpreting data
c. Generalizing

IV. Materials

Space Capsule Activity page
scissors
16 envelopes

V. Key Question

What would you send to another planet that might best exemplify how we live on the planet Earth?

VI. Management Suggestions

1. This activity may take 1-2 days to complete.
2. Reproduce two copies of the activity page for each student.
3. Label each of 16 envelopes with one of the listed categories for use in class.
4. If the choices within a category are too difficult or if this is a first time activity, it may be simplified somewhat by suggesting that all events or items emerge from only the twentieth century.

VII. Procedure

1. A suggested introduction may read as follows:

Let us assume that information has been gathered to indicate that extra-terrestrial life exists on other planets. Also let us assume that Life, with the ability to think, has been found; and now we wish to communicate with them. Because the distance between planets is so great, it would be impossible for us to travel there. So instead, we are going to send a rocket with a time capsule containing 16 well chosen items that will interpret and exemplify life on planet Earth. What should the capsel contain?

2. Each student responds individually by recording his or her choice in each of the 16 categories. Student files that page away for reference later.

3. Students meet in groups of three to four to discuss and come to agreement on responses and record on a second activity page. Record the number of students in each group in the small square at the bottom right corner of each category heading. Students cut second activity page apart and sort all responses by category into appropriately marked envelopes.

4. Students will then sort responses within each category to determine the top three responses in each category and the number of students selecting that item. Graph the total number of responses on the graph provided for each category.

5. Students will then predict how their responses would compare with students in similar age groups in different geographical areas.

6. Students will gather data to substantiate their predictions by corresponding with classrooms from other parts of the United States

IX. Discussion

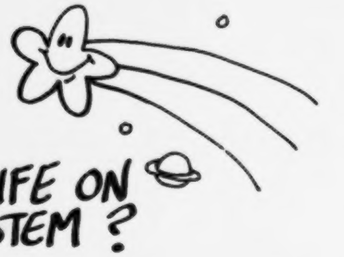
1. What factors or variables influence one's choices within a category?
2. Discuss how one places value or worth on a given choice.
3. What methods were used to prioritize responses to any one question or category?

X. Extensions

1. Compare results in a survey conducted by students of their parents or grandparents. Where are the similarities and the differences?

2. See Space Capsule 2 where information is shared from a similar survey of Soviet youths. Compare.

SPACE CAPSULE



WHAT WOULD YOU SEND TO INTELLIGENT LIFE ON A PLANET OUTSIDE OUR SOLAR SYSTEM?

1. A documentary photo is to be enclosed in the capsule. What event of the century should it show?

2. What document of historic importance to all mankind should be put in the capsule?

3. The biography of what great man of our epoch should be enclosed in the capsule?

4. The portrait of what man or woman who has brought the most glory to our century should be included? Who is the most selfless and courageous individual of our century, the individual we wish to emulate?

5. A description of what outstanding scientific discovery of our time should we send?

6. A replica of what engineering invention should be sent?

7. What modern tool should be included?

8. What household appliance is the most typical of our time?

9. What piece of sports equipment should we send?

10. What work of fiction should we send?

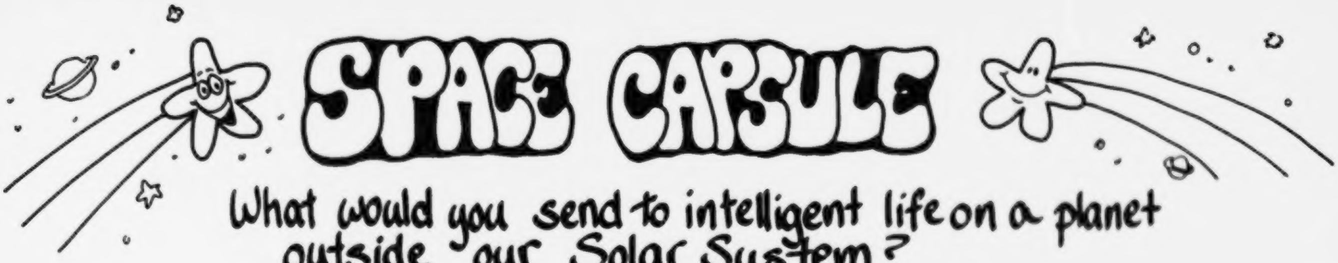
11. A recording of what musical work should we send?

12. What feature film would you send?

13. A reproduction of what painting or sculpture should be included?

14. A model of what type of architecture would you send?

15. We still have room in the capsule for one more object. What do you suggest?



What would you send to intelligent life on a planet outside our Solar System?

Think about what you would send to represent human life on earth. Write down your responses. Cut apart the strips, place the strips into groups. Tabulate and display your results by graphing.

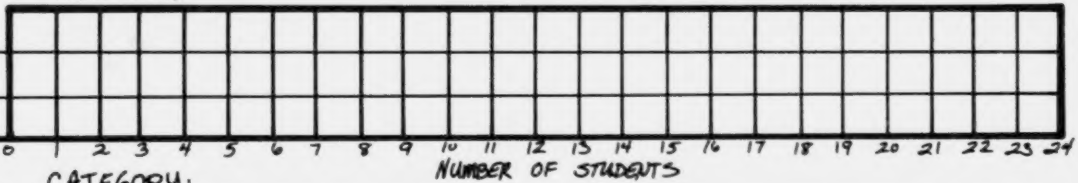
FAMOUS PERSON:	IMPORTANT INVENTION:
PAST EVENT:	APPLIANCE:
MOVIE:	ELECTRONIC EQUIPMENT:
TELEVISION PROGRAM:	SAMPLE TRANSPORTATION:
BOOK:	SAMPLE SPORT EQUIPMENT:
COMIC STRIP:	GAME:
MUSIC:	TOY:
FOOD:	YOUR CHOICE:

TOP 3 Responses

SPACE CAPSULE - SURVEY RESULTS

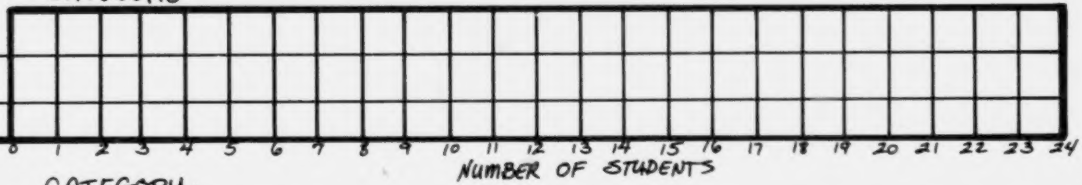
CATEGORY:

1.
2.
3.



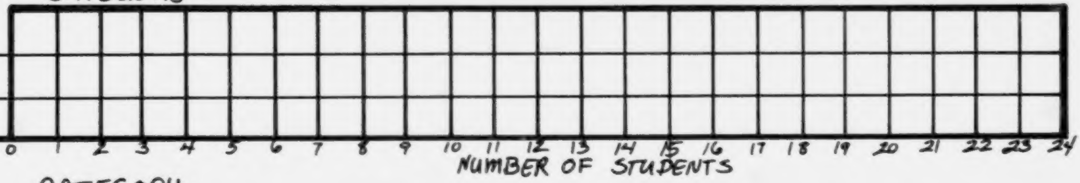
CATEGORY:

1.
2.
3.



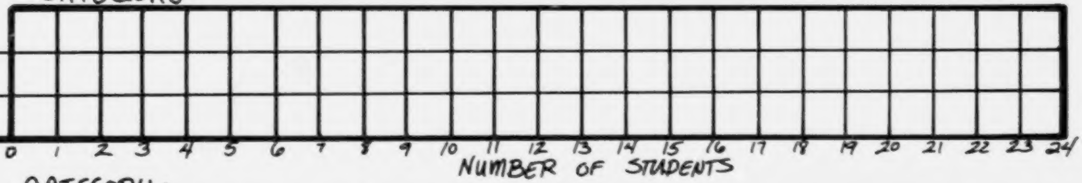
CATEGORY:

1.
2.
3.



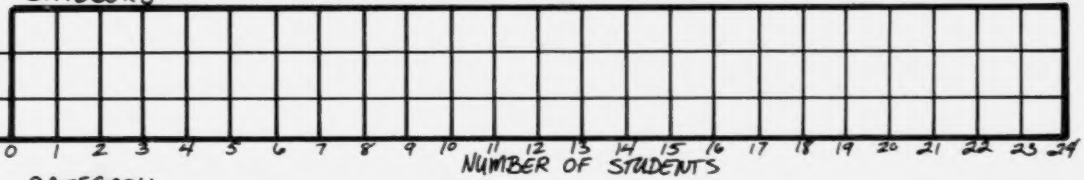
CATEGORY:

1.
2.
3.



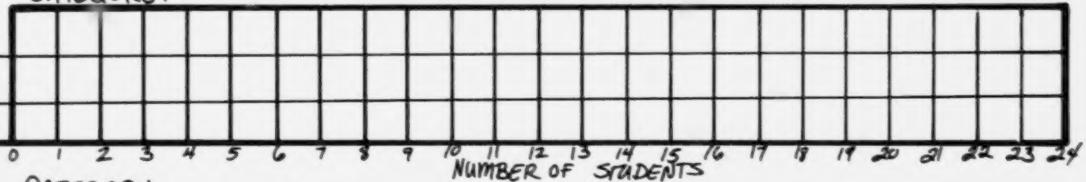
CATEGORY:

1.
2.
3.



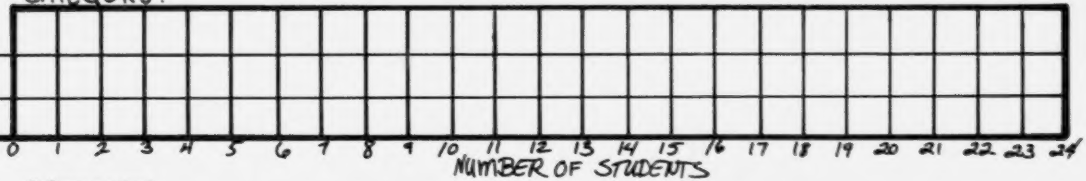
CATEGORY:

1.
2.
3.



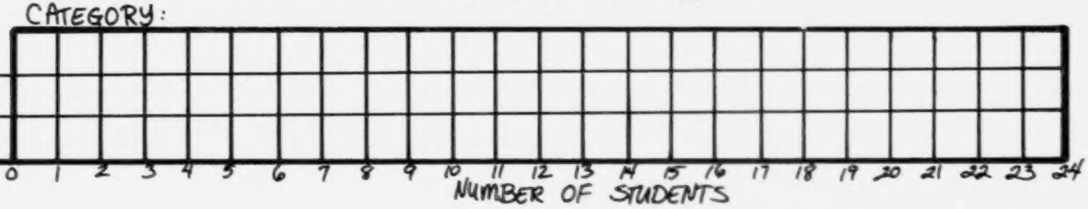
CATEGORY:

1.
2.
3.



CATEGORY:

1.
2.
3.



LET ME COUNT THE WAYS

I. Topic Area:
Measurement in non-standard units

II. Introductory Statement:
Concept of measurement will be explored by weighing various objects with Teddy Bear counters.

III. Math Skills

a. Counting
b. Measurement
c. Graphing
d. Estimating
e. Comparing
f. Sequencing
g. Logic

Science Processes

a. Predicting
b. Observing and Identifying
c. Communicating
d. Recording Data
e. Analyzing
f. Generalizing

IV. Materials:

Teddy Bear counters
Eraser
Scissors
Box of eight crayons
Small block of wood
Tennis ball or small rubber ball
Small lump of clay
Primer balance

V. Key Question:
Which of these objects will weigh the most?

VI. Background Information
Measurement in its simplest form is a direct comparison of one object to another to answer questions like: Which is more? or less? or the same? When direct comparisons are not accurate enough, a unit of measure becomes necessary. Because a unit such as a centimeter or a gram has no meaning for a young child, we use uniform counted objects to build the idea of measurement.

VII. Management Suggestions

1. Six easy to find objects have been suggested for this activity. Teachers may want to substitute or replace them with other objects. In such a situation, use the open-ended activity page. Others may wish to use it as an extended activity to re-inforce the process.

2. Be aware that the strips supplied have only 12 spaces so no object weighing more than 12 units may be displayed on these strips unless you put two or more strips together. The strips may then be placed side by side to produce a graph.

VIII. Procedure

1. The teacher displays the six objects. Students make a record of their guess of how the objects would line up from light to heavy by cutting out and gluing the pictures of the objects onto the chart provided under the heading MY GUESS.
2. Ask students to select and record the object they think is the lightest. Students then estimate and record how many Teddy Bears they think it will weigh on the appropriate activity page.
3. Use two colors of Teddy Bear counters to weigh the object. Count and record. Add the two colors to get the total weight.
4. Repeat for all six objects. Cut out and glue the second set of pictures of objects onto the chart under the heading Weigh and Count to show the actual order of objects from lightest to heaviest.
5. Make a strip of colored Teddy Bear counters for each object weighed. Color in the appropriate number of bears. If the object weighs more than 12 bears, add an additional strip or part of a strip. If the object weighs less than 12 bears cut the strip at the appropriate level.
6. Sequence the strips from few Teddy Bears to many Teddy Bears to show the order of objects from light to heavy. Glue or staple side by side to make a graph and show the staircase effect produced if the objects are sequenced properly from lightest to heaviest.

IX. Discussion

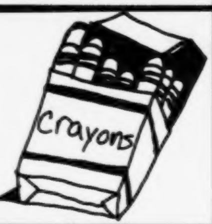
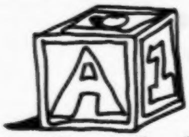
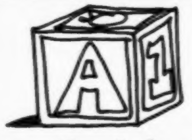
1. Which of the six objects was the lightest? Which was the heaviest? How do the strips show us which is heavier? lighter? the same?
2. Compare one object to another by asking, "Is the ______ heavier than the ______ ?" "How much more does the ______ weigh than the ______?" "Can you find two objects that weigh the same?" "Can you find an object that weighs two more than the ______?" "Can you find an object that weighs three less than the ______?"
3. Relate the graph, the series of strips, to ordering the objects from light to heavy. If the graph shows a staircase, each step getting higher, the sequence was accurate. The steps may not always be equal jumps, but they will always be upward.

X. Extensions

1. See Teacher Page for ways the process may be re-inforced by using a variety of manipulatives for measuring. Sample strips have been provided for teacher convenience in converting the existing strips of bears to strips of Unifix cubes, kittens, marbles, pennies, paper clips or jelly beans. Follow the procedure as described above.

Let Me Count the Ways...

Cut out the "My Guess" pictures. Glue or lay them in the chart from lightest to heaviest. Weigh and count. Cut out the "Weigh and Count" pictures. Glue them in the chart to show the results.

My Guess:	Weigh and Count:
eraser	eraser
 Crayons	Crayons
scissors	scissors
clay ball	clay ball
tennis ball	tennis ball
 wooden block	 wooden block

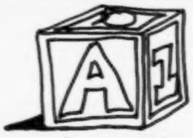
My Guess:	Weigh and Count:
Lightest	Lightest
Heaviest	Heaviest

Let Me Count the Ways

Choose bears of only two colors to weigh each object.

My two colors are ______ and ______.

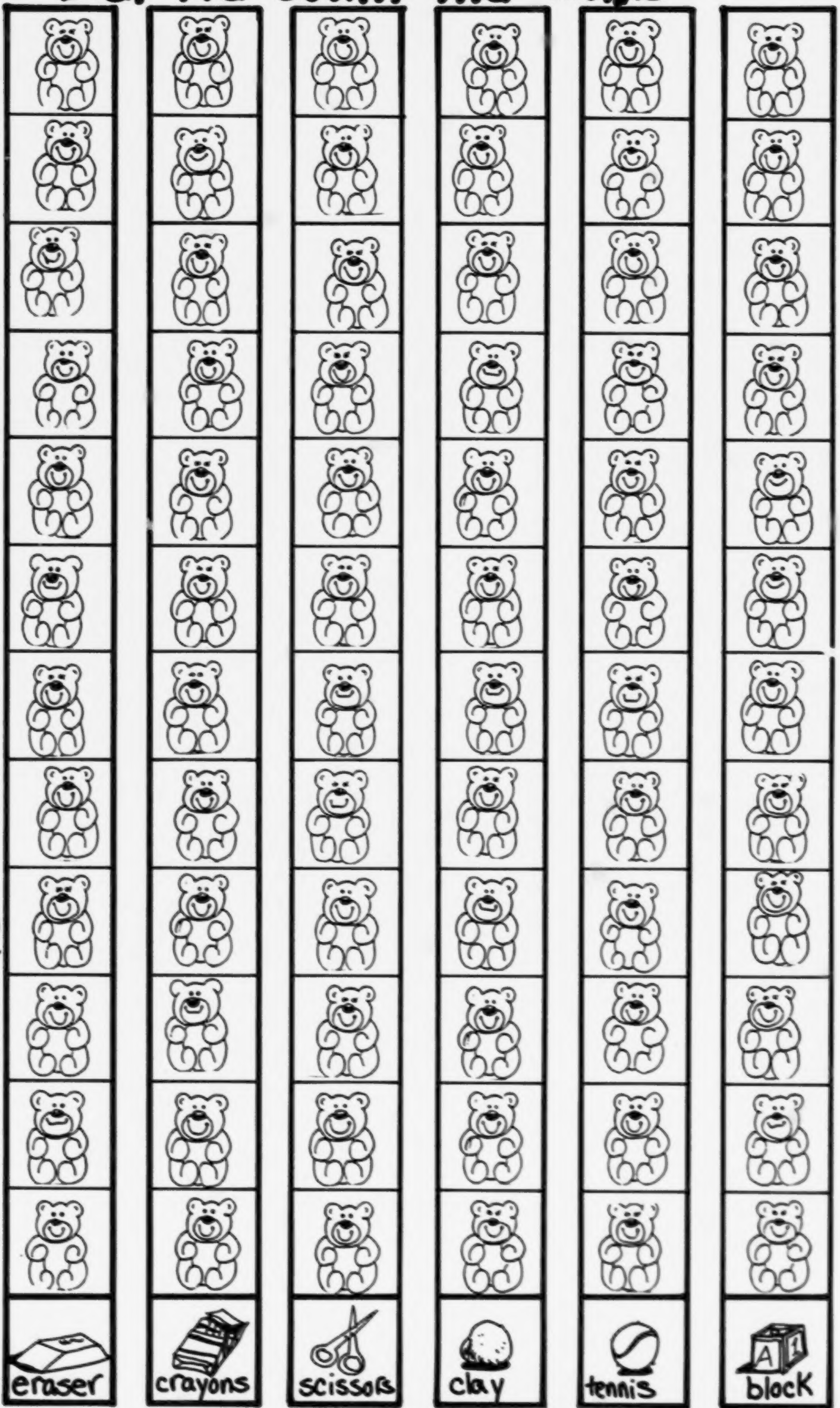
Record the number and color of bears.

	My Guess:	Weigh and Count:
 eraser	______ bears	______ + ______ = ______ bears
	______ bears	______ + ______ = ______ bears
 scissors	______ bears	______ + ______ = ______ bears
 clay ball	______ bears	______ + ______ = ______ bears
 tennis ball	______ bears	______ + ______ = ______ bears
 wooden block	______ bears	______ + ______ = ______ bears

Let Me Count the Ways

1. Weigh and Count.
2. Count and Color.
3. Cut out each strip.
4. Put strips in order from few to many.

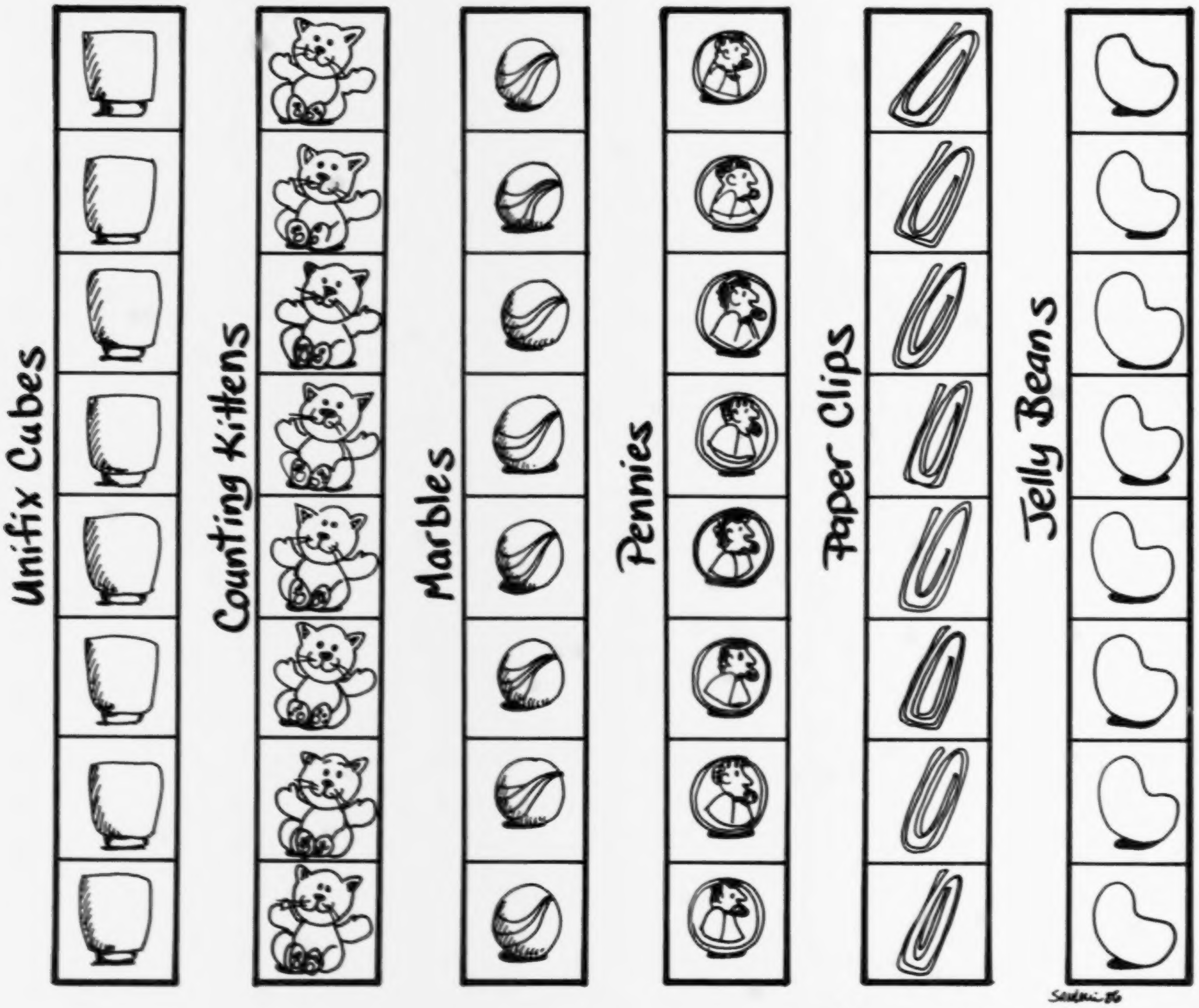
5. Glue the strips on another piece of paper.



Let Me Count the Ways...

Children do not necessarily use "adult logic" in problem solving. Their thought processes are often very different from ours. Piaget and others suggest that children learn best by active participation, on a concrete level, in a measurement activity where they have many opportunities for discussion and process reinforcement through repeated experiences with a variety of manipulatives.

Therefore, you may wish to use the open activity page and count the ways with . . . .



FLOATING AND SINKING

GENERAL INFORMATION

Objects will float or sink depending on the amount of water that they displace. The force that seems to hold objects up in water is called "buoyancy." This principle says that when a body (object) is placed in fluid (water), the weight it seems to lose is equal to the weight of the fluid that it displaces. This discovery about buoyancy is called "Archimedes' principle."

If container A is placed inside container B which can collect the water that overflows, and container A is filled to the brim with water, Archimedes' principle can be demonstrated. After submerging an object, such as an apple, in container A, pour the water that overflowed into container B into a balance scale pan. Place the apple in the pan on the opposite side of the scale. The pan with the water will be lower because it (the water) weighs more than the apple. If the same procedure were followed using an egg, the water that overflowed (displaced) would weigh less than the egg.

In the science laboratory specific gravity, which indicates how the density of one material compares with the density of water, is calculated using distilled water that is 4° Celsius. The above information is generally not necessary for the "Floating and Sinking" activities on the Student Activity Sheet. However, high achieving intermediate grade students might find it interesting to complete some of the suggestions listed under "Application of Concept and Extension Activities."

MATERIALS

Use a large salad bowl filled almost to the top with water. Gather the materials listed on the activity sheet or substitute a variety of others.

PROCEDURE

Have students make predictions before conducting experiment. Follow procedures 1 through 3 as indicated.

POSSIBLE ANSWERS TO QUESTIONS

1. Answers will vary in predictions. List objects that floated.
2. Answers will vary in predictions. List objects that sank.
3. Answers will vary. Students will probably indicate that for their size (mass) they were relatively light.
4. Answers will vary. Students will probably indicate that for their size (mass) they were relatively heavy.
5. This experiment demonstrates that light objects usually float and heavy objects usually sink. (This explanation is usually sufficient for kindergarten and primary students, however, some of the extension activities suggested below might be applicable.)

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

1. Discuss or try the following:
   A. What would happen if the clay was flattened and then placed carefully on the surface of the water? (If the edges are bent upward to form a hull, the clay will float.)
   B. Have students bring different kinds of cloth (cotton, silk, wool, etc.) and place them in the water to see what happens.
   C. Try different sizes and kinds of paper. Leave them in the water for several minutes to find out the results.
   D. How could one make the thumbtack float? (Stick it into the cork or eraser.)
2. If a balance scale is available, place the cork on one side and then add small paper clips or straight pins until both sides are balanced. Place the glass or jar in an aluminum pie tin. Stick a straight pin into the cork. Holding the cork with the pin, immerse it in the water until it is completely submerged. The water flowing from the glass will collect in the pie tin. Pour the water into the tray on the balance scale opposite the clips or pins. What happens to the balance scale? (The side with the water is heavier than the clips or pins so it will be lower. If the clips or pins are removed and replaced by the cork, the scale will once again balance.)
3. Have some of the advanced students research Archimedes and give a report.

Floating and Sinking

Materials:

Large dish or aquarium

cork
pencil
paperclip
thumbtack
eraser
pin

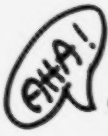
paper
cloth
rubber band
screw
clay
marble
rubber ball

Procedure:

1. Fill the container 3/4 full of water.
2. Try floating each object in water.
3. Make a record of which objects float and which sink.

Questions:

1. Which objects floated?
2. Which objects did not float?
3. What did the floating objects have in common?
4. What did the objects that did not float have in common?



5. What does this experiment demonstrate?

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

BULK RATE
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please
circulate
to all
teachers

AIMS NEWSLETTER
A Publication of the AIMS Education Foundation
Volume 1, Number 5 December 1986 ©AIMS Education Foundation

Hawaii Selects AIMS for Statewide Program

Miles Muraoka
State Educational Specialist in Science

Under Title II of the Education for Economic Security Act P.L. 98-377, state education agencies were permitted to propose courses of action to be funded to improve mathematics and science education. The Hawaii Department of Education proposed two separate efforts, one for secondary schools and the other for elementary schools. This article describes how Project AIMS became an integral part of improvement efforts in elementary mathematics and science programs in Hawaii.

The early years of this decade were punctuated by numerous reports that cited general shortcomings of public schooling and specific deficiencies in subjects like mathematics and science. Attending to the findings and recommendations of various national commissions and boards to strengthen instruction in mathemetics and science provided a number of foci for action. EESA, Title II, was viewed as a means for emphasizing recommendations common to both subject areas that involved higher order thinking skills and application skills development in students.

Hawaii's public schools are organized as a single school system composed of seven administrative districts which employs approximately 5,000 elementary teachers. The private and parochial school sector employs appproximately 900 elementary teachers. Our problem was to design and initiate an improvement project in elementary mathematics and science that would involve these teachers in significantly affecting the following:

1. Call attention to the needs in elementary mathematics and science programs (most of which led to enactment of EESA) and to implement a highly visible project that addressed the needs;
2. Implement training to reach a "critical mass" of elementary teachers, estimated at 40%, to energize improvements by disseminating a selected program's philosophies, strategies, and techniques; and
3. Actively support classroom teachers by providing materials and equipment to achieve desired instructional objectivies.

Miles Muraoka is the Hawaii State Educational Specialist in Science. May Hoshino is the Honolulu District Resource Teacher in Mathematics and Roy Takayama is the Honolulu District Resource Teacher. in Science.

Roy Takayama, shown above, and May Hoshino provide the leadership in AIMS in-service training in Hawaii.

The Hawaii State Department of Education reviewed and evaluated a number of available programs to select one which would enable elementary schools and teachers to begin to carry out the overall purpose and intent of EESA and to focus on improving thinking and application skills development in students. Project AIMS was selected as the program to invest in because of two overriding characteristics: (1) the versatility of AIMS modules when applied to correcting specific gaps in elementary instructional programs such as thinking and application skills development, the quantity and quality of mathematics and science instruction, and teacher attitudes about mathematics and science as disciplines and as subjects to be taught; and (2) statements made by developers that Project AIMS materials were **not** completed and will continue to evolve through refinements and the development of additional modules, an attitude critical for our needs. In retrospect, it appears that these two characteristics more than any other have been responsible for the successes we have thus far enjoyed.

(see Hawaii, page 4)

Hawaii Leaders and Writers Given Strong Commendation

Judith A. Hillen

In August 1986 at the invitation of Miles Muraoka, Science Educational Specialist, the Directors of Project AIMS, Dr. Arthur Wiebe and Judith Hillen, joined leadership with May Hoshino and Roy Takayama to conduct a one-week AIMS Writing Workshop in Honolulu. The purpose of this experience was to produce a set of locally-focused AIMS activities and to encourage individual teachers to continue to develop lessons of their own in a similar fashion that would capture the philosophy and methodology of AIMS. . . a very ambitious goal!!!

As we reflect upon that delightful week in Hawaii, we remember a group of enthusiastic, hard working and generous teachers who endeared themselves to us in so many special ways. We were welcomed upon our arrival with most beautiful flower leis. . . the first I had ever received. Each day we experienced true Hawaiian hospitality in lavish amounts of Hawaiian, Japanese, and Filipino culinary treats including first time tastes of Mochi-crunch, crack seed, yummy home-made Haupia, a variety of fish and dried sea-weed and the list goes on.

Lest one thinks that all we did was feast on these goodies, we were most impressed too by the commitment to excellence in meeting the ambitious goals set by this team. Within one week, they researched information for and designed 26 hands-on activities complete with student activity sheets and fact pages. What a fine contribution to teachers and students alike.

It was evident throughout the week that the AIMS training provided by May Hoshino and Roy Takayama to teachers throughout all of Hawaii was of superior quality. We were able to see how clearly the AIMS philosophy and the Math Model were transmitted and implemented.

Our week culminated in a lovely send off complete with a crown of flowers hand-made by May Hoshino and leis of handwrapped Hawaiian taste treats for our trip home. Hawaii was truly a memorable experience. We salute them and we are proud to have them as an integral part of the AIMS family.

AIMS NATIONAL LEADERSHIP NETWORK

Listed are the members of the AIMS National Leadership Network. Members are qualified to conduct Project AIMS workshops, teach AIMS in-service courses for college credit, and serve as Project AIMS consultants.

MAUREEN ALLEN	Irvine, California
DONNA BATTCHER	Sparks, Nevada
JOE BLANC	Turlock, California
JOHN CAMPOPIANO	Modesto, California
HELEN CROSSLEY	Rialto, California
PAT DAVIS	Bakersfield, California
SUE DIXON	Monterey, California
SHELDON ERICKSEN	Fresno, California
KAY FLETCHER	Huntington Beach, California
ROBERT & DOROTHY GLOYD	Auburn, California
MARY GREEN	Newberg, Oregon
JUDY HARRISON	Hanford, California
DONNA HENSON	Redding, California
MAY HOSHINO	Honolulu, Hawaii
KEN KITAJIMA	San Jose, California
MARY LIND	Monterey, California
CAROLYN LITTLE	Palm Desert, California
SHERYL MERCIER	Fresno, California
ART RING	Campbell, California
KIM SUTTON	McKinleyville, California
FRAN THREEWIT	Santa Rosa, California
ROY TAKAYAMA	Honolulu, Hawaii
ANN WIEBE	Reedley, California
DAVE YOUNGS	Zaire, Africa

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California 93747. Volume I, No. 5.

EDITORS	Arthur Wiebe, Judith Hillen
STAFF ARTIST	Sheryl Mercier
OFFICE MANAGER	Sheryl Bishop
PROGRAM DIRECTORS:	
Fresno Pacific College Math/Science Project	Lawrence E. Ecklund
AIMS Education Foundation	Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes	Ted Ostrander
Project AIMS	Judith Hillen, Arthur Wiebe
Project SETUP	Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION

PRESIDENT	Arthur Wiebe, Ed.D.
VICE-PRESIDENT	Wilbert Reimer
SECRETARY	Lawrence Ecklund
TREASURER	Jon Hillen
ACCOUNTANT	Robert J. Dwyer
STAFF ARTIST	Sheryl Mercier

• THIS ISSUE • THIS ISSUE • IN SUMMARY • THIS ISSUE • THIS ISSUE •

The Hawaii Story

Miles Muraoka, Hawaii State Educational Specialist in Science shares the carefully designed plan used to implement AIMS throughout the state. **See story, Page 1.** Judith Hillen gives a personal glimpse of the week she and Arthur Wiebe spent with selected teachers in Honolulu writing some "native" Hawaiian AIMS investigations. **See page 2.** One of the lessons developed during the week together with a fact worksheet about pineapples (naturally) is adapted for inclusion in this issue. **See Pages 19-23.**

A study of Basic Operations and the Model of Mathematics

The first of two articles dealing with the Model of Mathematics and bacis operations begin in this issue. The operations of addition and multiplication are examined. **See page 6.**

AIMS Implemented in Auburn

The Auburn Union Elementary School District is using an excellent model for implementing AIMS that is attracting wide-spread interest. **See Auburn, AIMS, Action! Page 8.**

More 1987 Summer Off-Campus AIMS Workshops Announced

A total of eight summer AIMS Workshops have now been scheduled. Additional sites will be announced in the January Newsletter. **See story, Page 10.**

How Many Chords?

This month's mathematics poster features a study of the number of chords which can be drawn in a circle with a given number of points. **See poster on Page 11.** General result: $\frac{n(n-3)}{2}$.

The Magic Circle Revisited

What happens when a vlaue of one unit of length is assigned to the radius of the circle? We revisit the Magic Circle discussed in the November issue. **For the result, see the story on Page 12.**

Life Savers

There is more to explore in this new AIMS investigation than taste. **See pages 14-18.**

Summer On-Campus AIMS Workshops Announced

Four Integrated Math-Science Workshops will be offered at Fresno Pacific College next summer offering graduate credit. **See page 24.**

Phone Home

This is another investigation from the fourth-coming publication entitled "Out of This World" and dealing with the solar system. **See pages 25-29.**

How Does a Plant Carry Water?

Your students can study this question with the science poster and investigation in this issue. **See pages 30-31.**

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ____________________

Address: ____________________

Street City

____

State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747

Hawaii, continued . . .

Commencing in the Summer of 1985, expenditures of EESA funds were first directed to insuring the development of a strong cadre of teacher trainers. May Hoshino, Honolulu District Mathematics Resource Teacher, and Roy Takayama, Honolulu District Science Resource Teacher, were selected to attend an Integrated Mathematics and Science Workshop at Fresno Pacific College from July 8-12, 1985. Their combined expertise, experience, and interest in integration curriculum for elementary schools were more than could hoped for. Following training, they formulated a local training program that was tested with a group of grades 4-6 teachers during August and refined in October while training their counterparts from six other school districts. This training program contains the essence of the Integrated Mathematics and Science Workshop interwoven with goals and objectives of the Hawaii Department of Education for mathematics and science.

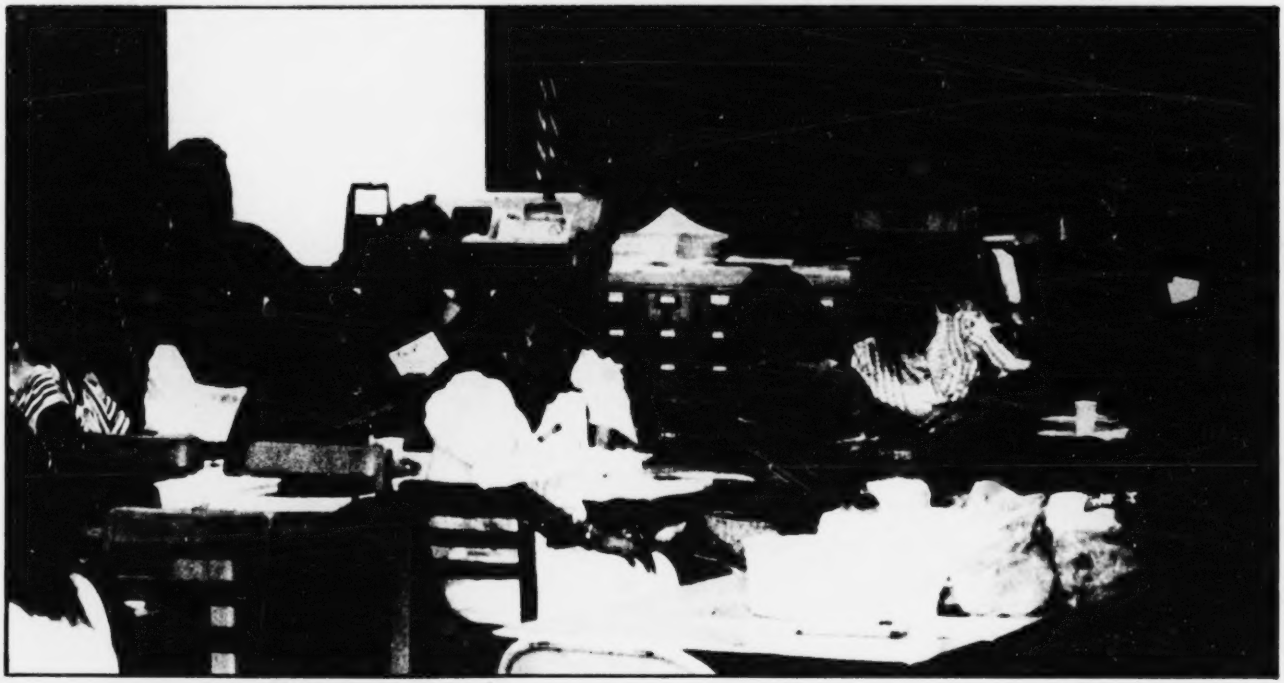
Each training session is scheduled for 10 hours during which participants are provided explanations and demonstrations of Project AIMS philosophy, rationale, and approaches. Selected activities are used for participants to experience Project AIMS as students which is followed by each participant selecting an activity and presenting it as a teacher. This two-level, experiential approach is economical and encourages teachers to try a lot more activities than one would imagine possible in 10 hours of training. Upon completion of training, each participant receives a set of Project AIMS modules and a kit of classroom equipment to do the following:

1. Conduct a Project AIMS activity of choice once a week, and
2. Train one other teacher from his/her school and share the materials with him/her.

Above and Opposite Page
"Parent's Day" AIMS activities at Kaala Elementary School. Kathrine Fujii is the AIMS teacher leader.

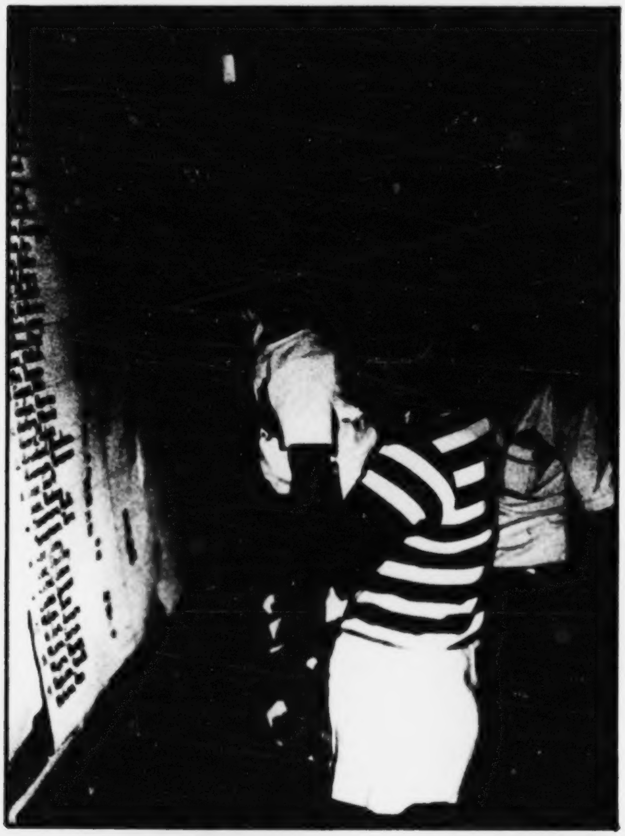
Providing a Project AIMS activity once a week for students is intended to regularly attend to developmental needs such as thinking and application skills. Over the course of a year, the cummulative effects of these enabling activities may, as one "pioneering" Project AIMS teacher put it, ". . . make total class participation a reality because each child has something to contribute."

Below
A systematic teacher in-service program is a hallmark of Hawaii's program for implementing AIMS.



Having a formally trained teacher informally train another teacher is intended to reinforce the initial training, stimulate innovations and techniques that focus on thinking and application skills, and, most importantly, build a base for mutual support and instructional experimentation for expanding the repertoire of activities using the Project AIMS approach. During the 1985-86 school year, 300 teachers of grades 4-6 were formally trained and at least another 200 trained by their peers. Some have trained entire school faculties. Follow-up and monitoring activities are being conducted with Project AIMS teachers during the current school year, and a new cycle of training that continues with 150 teachers of grades 4-6 and 300 teachers of grades K-3 is projected.

Nurturing the interest, enthusiasm, and expertise of Project AIMS trainees is a vital objective in improving mathematics and science education. To this end, a small group of teachers, some with and some without Project AIMS experiences, were invited to participate in a one-week AIMS Writing Workshop during August of 1986. Dr. Arthur Wiebe and Mrs. Judith Hillen provided the major guidance and instruction for the workshop which was led by May Hoshino and Roy Takayama. Products of this activity included 26 locally-focused "AIMS" activities and a new hybridized group of Project AIMS enthusiasts. A sample lesson from this collection accompanies this article and it will, along with the others, be reproduced as an "AIMS module" to serve as a model for encouraging individual teachers to similarly develop lessons of their own. This workshop has led us to conclude that teachers can and are willing to write lessons that capture the philosophy and strategies of Project AIMS. We have included a lesson writing segment into our training program and hope to develop an AIMS exchange through which good teachers and good teaching can be recognized.



School administrators, parents, and other interested individuals are also important target groups to be nurtured for support of improvement efforts in elementary mathematics and science. A commonly used implementation strategy for new programs or ideas is to convene school administrators to "carry the message" for their faculties to implement. We modified this approach by directly working with teacher volunteers willing to make Project AIMS visible in schools prior to its formal introduction to school administrators. The rationale was to provide a trained Project AIMS resource teacher at the school level who could expand on information gathered during the meeting of administrators. We like to believe that this strategy has resulted in several schools initiating their own implementation scheme based on the leadership of an AIMS trained teacher and his/her school administrator.

Parents have been involved in "Parents Day" and other activities where they have participated in Project AIMS activities along with their child. This effort was begun this year along with more generalized sessions in conjunction with conferences, training sessions, and meetings of community groups.

Hawaii has used Project AIMS to begin specific improvement efforts in elementary mathematics and science education. We can see the leverage it can provide for making broader and more sweeping improvements in elementary education. We hope to grow along with Project AIMS and significantly alter some long-standing attitudes about elementary student competencies and elementary instruction in mathematics, science, and other subject areas.

Basic Operations and the Model of Mathematics

Dr. Arthur Wiebe

(Ed. Note: This is the fourth in a series dealing with the Model of Mathematics and its application in improving mathematics education.)

What students of mathematics need most is to make a connection between the mathematics they study at the abstract level and its concrete and representational forms. **Connectors** form this link. All too often connectors are the missing element in elementary and middle school mathematics.

The Model of Mathematics places a strong emphasis on connectors. We turn our attention now to the discussion of connectors as they relate to the four basic operations: addition, subtraction, multiplication, and division; and to such operations as finding the average and the square root.

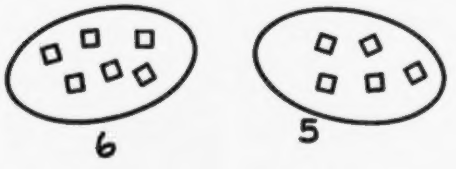
Connectors and Addition

There are two types of models for addition at the manipulative level: those that are countable and those that are to be measured. For the second type, the measurement of length is used.

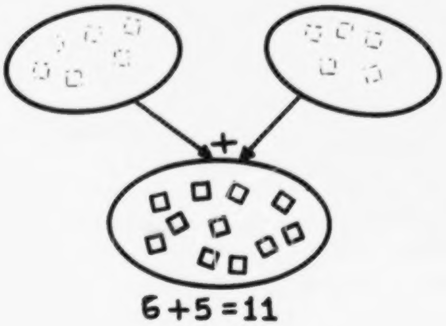
With countable objects, the operation consists of joining two sets to form one set. Usually, the two sets have a unequal number of objects. We "don't care" whether the sets have the same or a different number of objects and therefore addition can be characterized as an "I don't care operation".

Earlier in this series, the writer suggested that students in the early grades and at the introduction of most concepts should **"not lift a pencil in the mathematics class except to make a record of something they had done."** The purpose is obvious: we want to make the abstract notation to carry meaning derived from its real world origin. That guiding principle will be followed here.

First, students place objects into each of the sets as shown. They have now done something of which they can make a record. By counting, they can determine the number of objects in each set and make a record.



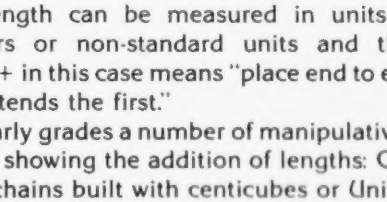
The second step is to perform an operation on these sets. They will both be moved into the same set. **This movement has a symbol and is denoted by "+".**



The result can be counted and recorded. No objects were lost nor were any objects gained through this manipulation. Therefore, the student can now relate the original sets, the movement, and the resulting set in a mathematical sentence: 6+5=11. Each part of this sentence has meaning: 6 and 5 were the original sets; + is the movement that joins them; 11 is the total number in the union; and, since no objects were lost or inserted, the two conditions are equivalent, =.

The concrete has been translated into the abstract. Similarly, students should be given experiences in which they translate the abstract into the concrete. The mathematical sentence 7+9=16 can be used as a command to be checked at the concrete level.

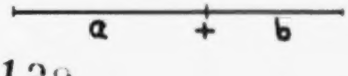
The addition of lengths consists of placing lengths end to end so one length is the extension of the other.



Each length can be measured in units such as centimeters or non-standard units and the result recorded. + in this case means "place end to end so the second extends the first."

In the early grades a number of manipulatives are excellent for showing the addition of lengths: Cuisenaire rods and chains built with centicubes or Unifix cubes.

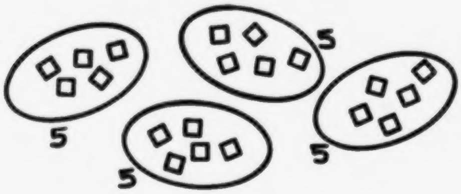
At the representational level, placing lengths end to end to indicate addition is often used in mathematics. a+b is shown as:



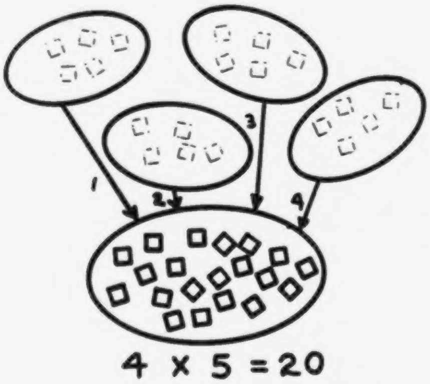
Connectors and Multiplication

In multiplication we insist that all sets must be equal. Therefore, it is an "I care operation." Viewed in this way, it is a special case of addition. Since the study of mathematics is "the pursuit of laziness" (always finding an easier way to do things) we find it time and effort saving to memorize the basic multiplication facts. It is far less work than continuing to use addition for this special situation where the addends are all alike.

In multiplication we work with the countable objects in the same manner as in addition except that each set must have the same number of objects.

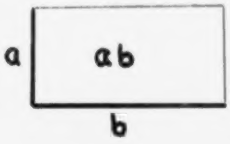


The record we make is slightly different. We count the number in each set and record it: 5. Then we count the number of sets to be moved together and record that: 4. Moving them all together at once is indicated by the symbol x.



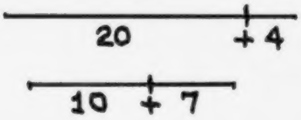
The mathematical model using lengths is particularly helpful at both the concrete and representational levels. **To multiply two lengths, we place them perpendicular to each other and complete a rectangle.**

The product is the area of the rectangle: ab.

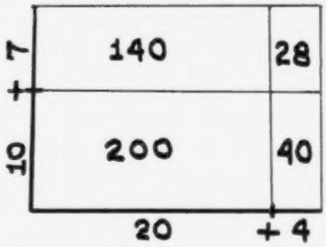


This model is excellent for illustrating multiplication. Let us consider the product of the two-digit numbers: 24x17. The illustration below is not drawn to scale. However, students could show the problem to scale using graph paper.

First, 24 will be represented as 20+4 and 17 as 10+7, emphasizing the "ten-ness" of our numeration system. The two lengths are now represented as:



Next, they are shown as being multiplied by placing the two lengths perpendicular to each other.



Then, the rectangles formed by the lengths and their component sections are drawn in and the area of each is computed.

Finally, the areas are added: 200+140+40+28=408. This process can now be compared with abstract algorithms. The first uses the distributive property:

$$(20+4)(10+7)=200+140+40+28=408$$

Set up in the vertical form it can be shown as:

```
  17
 x24
 ---
  28  (4X7)
  40  (4x10)
 140  (20x7)
 200  (20x10)
 ---
 408
```

Notice that this algorithm accurately perserves the concept of place value and forces the student to think in terms of the tenness of our numeration system, something that the standard shortcut does not do. For example, in the second sub-product the student thinks "I am multiplying 4 times 10, not 4 times 1" and in the final step the student is multiplying 20 times 10, not 2 times 1. Note that the representational form, the form utilizing the distributive property, and this abstract form all employ the same method.

The beauty of this representational form and its abstraction lies in the parallel to the algebraic form. Take for example the problem $(x+y)(x+y)$ or $(x+y)^2$. There are two sums, the elements of each laid end to end. The two expressions are arranged perpendicular to each other to show they are being multiplied.

(see Connectors, page 32)

Top Left Second graders explore pine cone in "Oh Christmas Tree" investigation.

Top Center and Right Fifth grade class constructs weather instuments during "Its in the Wind" investigation.

Lower Left Third and fourth grade students count their teeth in "Say Ah!" investigation.

Lower Right Teacher inservice is an integral part of the Auburn program.

Auburn, AIMS, Action!

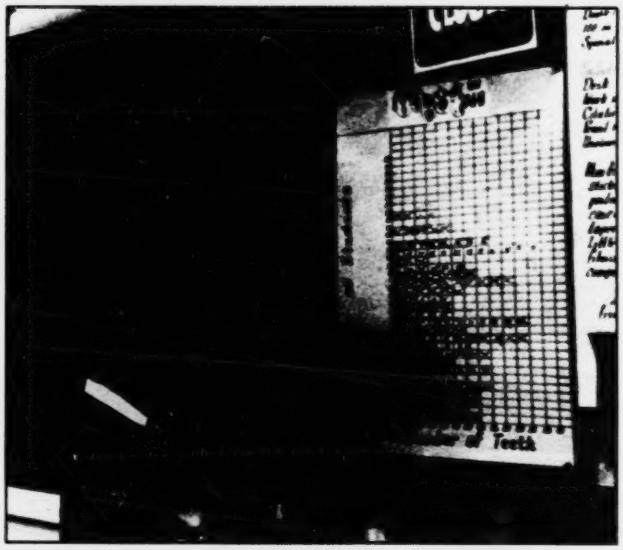
Activity- Centered Science Partnership

Dr. Del Alberti, Auburn District Superintendent

Activity-centered science is alive and well in the elementary classrooms of the Auburn Union Elementary School District! Following a series of district-sponsored classes and intensive curriculum guide development, the Auburn Union School District Board of Trustees adopted three activity-centered, non-textbook programs for the district's K-5 schools. The core elementary science curriculum consists of: *Project AIMS, Science On A Shoestring, Elementary Science Study* (selected units). Each classroom teacher has a comprehensive district science curriculum guide, all project AIMS guides for his/her grade level, and copies of *Science On A Shoestring, Creative Hands-On Science Experiences,* and *Creative Sciencing.* In addition, teachers may check-out *Elementary Science Study* guides and materials from a central science storage area at the District Office.

At the middle school level, grades 6-8, the district has adopted science textbooks which are used to extend *Project AIMS, Science On A Shoestring,* and *ESS* activities. In this initial district-wide implementation year, all district staff development activities focus upon activity-centered science. A full day pre-service staff development activity was conducted by Herb Strongin, State of California CIC Science Director and author of *Science On A Shoestring.* Four follow-up AB-65 workshop days, scheduled throughout the school year, have and will include as consultants: Dr. Larry Lowery, University of California, Berkeley; Carolyn Butler, *Project WILD*; and Herb Strongin. Science staff development activies are funded through state lottery monies. In addition, Project AIMS classes for college credit have been offered throughout the year by the district's science mentor teacher, Robert Gloyd, and mathematics mentor teacher, Dorothy Gloyd. Each elementary school in the district has a member of the AIMS National Leadership Network on its staff: Dorothy Gloyd (Lincoln Way School); Robert Gloyd (Alta Vista School); and Judy Harrison (Rock Creek School).

The key to having activity-science instruction occurring in every elementary school on a regular basis is a group of lottery-funded Science Curriculum Implementation Assistants. These four paraprofessionals, Charlene



Holland, Helen Power, Barbara Swendner, and Nancy Swenson, under the direction and training of the district's science mentor teacher, are assigned to specific school sites. Major duties of the science facilitators include:

★Assist in obtaining materials for use by teachers for their science lessons.

★Make charts, graphs, and other aids for use by teacher.

★Make suggestions to teachers for other activities and materials available for use on the same subject area.

★Assist with lessons, but not teach lessons, if time allows.

★Collect, sort, and store materials in central district science storage area for later use.

Sign-up sheets are provided for teachers to request help in each school. With their enthusiastic, helpful image, the science facilitators are in constant demand at each school site. One classroom teacher had remarked: "Christmas certainly has come early this year with this classroom support! All materials are provided so I do not have to spend time gathering them. I'm spending my time teaching science!"

Modeling learning as a life-long activity, the science facilitators meet weekly with the district's science mentor teacher for additional inservice and the opportunity to discuss school site success and concerns.

Another Key element in the program's success is the school principal. All principals have received training from the National Science Teachers Association *Project for Promoting Science Among Elementary School Principals*. Each Principal observes classrooms during science instructional time. In addition, principals are teaching, and enjoying, activity-centered science lessons on their school sites. The school district Board of Trustees, strongly committed to the improvement of science instruction, has developed through its five year curriculum goal continued funding for the replenishment of consumable science materials, new science guides as they are developed, and the maintenance of the classroom science support facilitators.

Science mentor teacher Robert Gloyd has remarked, "It is exciting to be in a Teachers' Room and hear the enthusiasm and enjoyment expressed by teachers about their students and the science lessons they have presented!"

Auburn's successful science partnership puts into action the September, 1986 recommendation from *First Lessons: A Report on Elementary Education*; "Activity-centered science taught by the regular classroom teacher illustrates the point that science is for everyone-not just scientists. . ."

Copies of the Auburn Union School District comprehensive science curriculum guide may be obtained for $12.40 by mailing payment and request to:

Linda Beasley, Secretary to the Superintendent
Auburn Union School District
1225 Lincoln Way, Room No. 3
Auburn, California 95603

More Off-Campus AIMS Workshops Announced

The AIMS Education Foundation has approved six more sites for AIMS Workshops in the summer of 1987, bringing the total to eight. These are in addition to the four offered on the Fresno Pacific College campus.

Several other invitations from school districts to host AIMS Workshops are currently under review. Applications to host such workshops are still being accepted. Information for hosting workshops may be obtained by writing to the AIMS Education Foundation.

Four of the five-day workshops have been scheduled in Southern California. All but the Azusa Workshop, which has two sections, will have three sections: K-2, Grades 3-5, and Grades 5-8. The locations and dates are:

Poway Unified School District, June 22-26
Ventura Unified School District, July 13-17
El Monte City School District, August 17-21
Azusa Unified School District, August 24-28

Three are scheduled in Northern California. The Mother Lode Union School District will host a two-section workshop (K-3 and Grades 4-8). The other two are three-section workshops. The locations and dates are:

Fairfield-Suisun Unified School District, June 22-26
San Jose Unified School District, June 22-26
Mother Lode Union School District, July 20-24

The first out-of-state workshop approved will be in **Edmonds, Washington** with the Edmonds School District serving as the host. This will be a two-section workshop scheduled for **June 29-July 3**.

Pre-registrations are required for all workshops together with a $50 deposit or district purchase order. All pre-registrations are to be submitted to the AIMS Education Foundation. A pre-registration form is included on this page. Enrollment in each section at each site is limited and early pre-registration is recommended to avoid disappointment.

In each instance, host schools are reserving up to sixty percent of the spaces for teachers from within the district and priority will be given to such teachers. However, in all cases, teachers from other districts are welcome and invited to attend. Out-of-district teachers should pre-register early in order to be assured of a space.

The basic off-campus workshop fee is $160 and includes about $40 worth of materials. Tuition for two semester units of college in-service credit is an additional $48 for a combined total of $208.

The $50 deposit is refundable only if two conditions are met: the request is made at least 45 days before the workshop begins and there is a replacement on the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

Next summer many teachers will have the basic fee paid by their schools who will use PL 98-377 funds for this purpose. PL 98-377 is a federally funded program to improve mathematics and science education. The funds are disbursed through the State Department of Education.

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name ______________________ Social Security No.______________

Street ______________________ City ______________

State ______________ Zip________ Home Phone (______)__________

School District ______________________________

School ______________ Grade Level________ School Phone (______)__________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

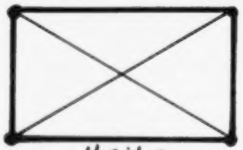
☐ Poway Unified School District, June 22-26
☐ Fairfield-Suisun Unified School District, June 22-26
☐ Edmonds (Washington) School District, June 29-July 3
☐ Ventura Unified School District, July 13-17
☐ Mother Lode Union School District, July 20-24
☐ El Monte City School District, August 17-21
☐ Azusa Unified School District, August 24-28
☐ San Jose Unified School District, June 22-26

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

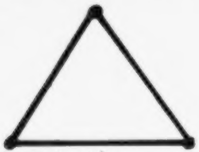
Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

Diagonal Challenge

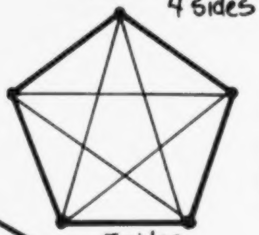
Find the total number of diagonals in a polygon with 12 sides by first examining a polygon with 3 sides, then a polygon with 4 sides, etc. until you see the pattern that emerges. Use the chart to record your results.



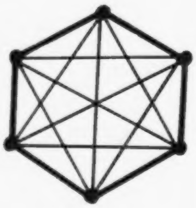
4 sides



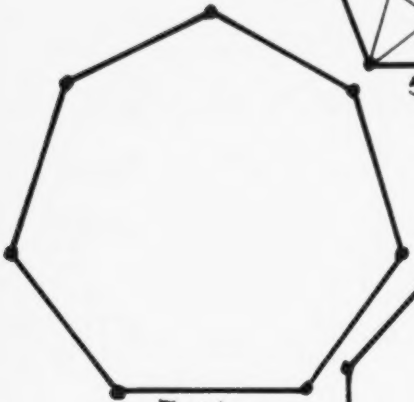
3 sides



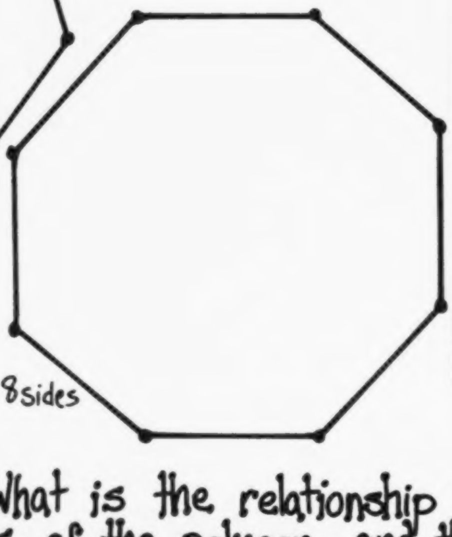
5 sides



6 sides



7 sides



8 sides

Number of Sides	Number of Diagonals
3	0
4	2
5	5
6	
7	
8	
9	
10	
11	
12	
n	

Questions: What is the relationship between the number of sides of the polygon and the number of diagonals?

1. How many diagonals would a polygon with 20 sides have?

2. How many diagonals would a polygon with n sides have?

The Magic Circle Revisited

Dr. Arthur J. Wiebe

The magic circle contains additional problem solving challenges!

We can revisit the magic circle and make quantitative computations of relative areas and perimeters by assigning a convenient value to the measure of the radius of the circle. For the following study we assign the value of 1 unit to the measure of the radius. All results, of course, are rounded off.

1. **If the measure of the radius is 1 unit,**
   - **a. what is the measure of the circumference?** (Diameter times pi or approximately 6.28 units)
   - **b. what is the measure of the area of the circle?** (Radius squared times pi or 3.14 square units)
2. **What conclusions can we draw from studying Figure 1.**

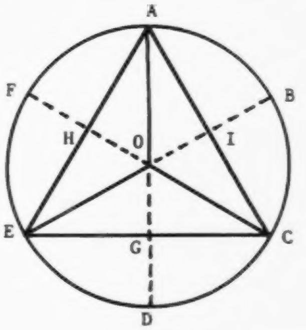


Figure 1

In Figure 1, lines are drawn from each vertex of the equilateral triangle to the circle passing through the midpoint of the opposite side of the triangle. From this we can make a number of observations. Note, these are observations and not formal proofs.

Line segments such as AG serve four functions: they are the angle bisectors, perpendicular bisectors of the sides, altitudes, and medians. This is true only in equilateral triangles.

The circle and the triangle have both been divided into six congruent regions by these lines. Therefore, the six central angles are congruent and each has a measure of 60 degrees; AG, CH, and EI are congruent; OC, OA, and OE are also congruent; therefore, OG, OH, and OI are congruent.

We know that the medians of a triangle intersect at a point two-thirds the distance from the vertex to the opposite side. Therefore, OC is twice the length of OH. Hence, OC is also twice the length of OG. If we assign the measure of 1 to the radius OC, then OG has the measure of ½.

3. **What is the measure of the perimeter of the inscribed triangle?** (3 $\sqrt{3}$ or about 5.196 units)

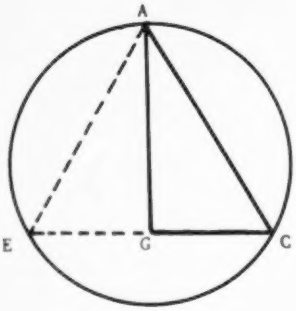


Figure 2

In figures 1 and 2, OC is a radius and has an assigned measure of 1 unit and hence OG has a measure of ½ unit. We also know that AG is perpendicular to EC and that OCG is a right triangle. Using the Theorem of Pythagoras (the sum of the squares of the legs of a right triangle is equal to the square of the hypotenuse) we find that the measure of GC is $\sqrt{3}/2$ units and EC a measure of $\sqrt{3}$ units.

Therefore, the perimeter of the equilateral triangle then has a measure of 3 $\sqrt{3}$ or approximately 5.196 units.

4. **What is the measure of the area of the inscribed triangle?**

Since the measure of a side is $\sqrt{3}$ from the above, our task is simplified. The base of triangle ADF has a measure of $\sqrt{3}$. The altitude has a measure of 1.5. Can you explain why? (OA has a measure of 1 and OG a measure of ½)

Therefore, the measure of the area of the triangle is ½($\sqrt{3}$)(1.5) square units or .75 $\sqrt{3}$ or 1,299 square units.

5. **Approximately what per cent of the measure of the**
   - **a. circumference of the circle is the measure of the perimeter of the triangle?** (5.196/6.28=82.7%)
   - **b. area of the circle is the measure of the area of triangle?** (1.299/3.14=41.4%)
6. **Consider the sector AOB, which is one-sixth of the circle,**
   - **a. what is the measure of its boundary?** (1+1+6.28/6=3.047 square units)
   - **b. what is the measure of its area?** (3.14/6=.52 square units)

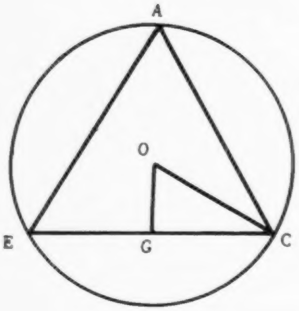


Figure 3

7. In Figure 3, what is the

a. perimeter of the right triangle? ($\sqrt{3}$+1.5+ $\sqrt{3}$/2 =4.098 units)

b. area of the right triangle? (½x $\sqrt{3}$/2x1.5=6.5 square units. Also, it is ½ the area of the equilateral triangle.)

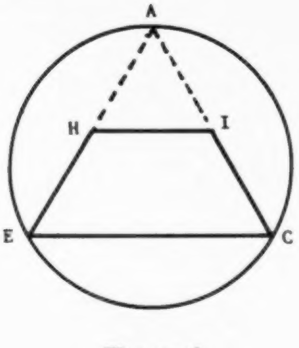


Figure 4

8. In Figure 4, what is the

a. perimeter of the isosceles trapezoid? (3x $\sqrt{3}$/2 + $\sqrt{3}$=4.33 units. The sides and top base have a measure of $\sqrt{3}$/2 and the bottom base a measure of $\sqrt{3}$.)

b. area of the isosceles trapezoid? (3/4x1.299= 0.974 square units)

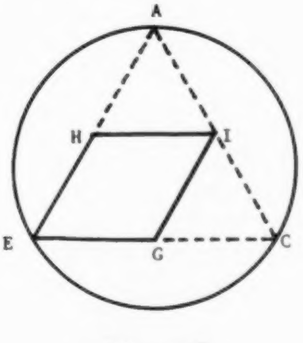


Figure 5

9. In Figure 5, what is the

a. perimeter of the rhombus? (4 $\sqrt{3}$/2=2 $\sqrt{3}$=3.46 units)

b. area of the rhombus? (½x1.299=.649 square units)

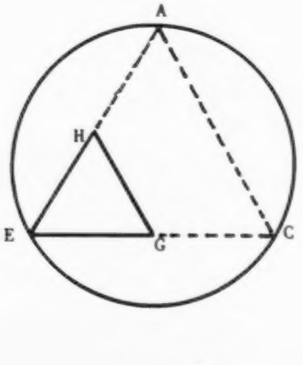


Figure 6

10. In Figure 6, what is the

a. perimeter of the small equilateral triangle? (3 $\sqrt{3}$/2=2.6 units. Also ½ that of the large equilaterial triangle or 2.6 units.

b. area of the small equilateral triangle? (1/4 that of the large equilateral triangle or .325 square units)

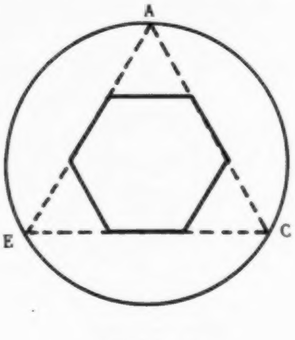


Figure 7

11. In Figure 7, what is the

a. perimeter of the large hexagon? (Since each side of the original triangle has been trisected the measure of the six sides of the hexagon are equal to the measure of two sides of the triangle or 2 $\sqrt{3}$=3.46 units. Note that the original triangle has been divided into nine congruent equilateral triangles. Hence each side of the triangle must have been trisected.)

b. area of the large hexagon? (6/9 or 2/3 that of the original triangle, or 2/3x1.299=.866 square units)

12. In Figure 7, the large hexagon has been divided into six smaller hexagons, each of which is an equilateral triangle. What is the

a. perimeter of the small hexagon? (1.73 units or ½ the perimeter of the large hexagon)

b. area of the small hexagon? (1/6 that of the large hexagon or 1/9 that of the original triangle. 1/6x .866=.144 square units)

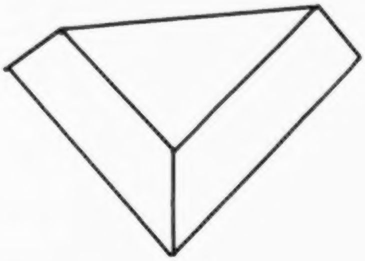
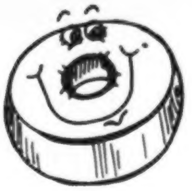


Figure 8

13. In Figures 8, what is the total surface area of the truncated tetrahedron? (From the previous section we know that the area is 7/9 of the area of the large triangle. Therefore, the total surface area is 7/9x1.299=1.01 square units. This is about 32.2% of the area of the circle.)



LIFE SAVERS

I.Topic Area
Patterns, arrangements (permutations), and problem solving with Life Savers.

II. Introductory Statement
Students will use a role of Life Savers to explore frequency and sequence of colors and flavors.

III. Math Skills	**Science Processes**
a. counting	a. predicting
b. sequencing	b. hypothesizing
c. patterning	c. organizing data
d. graphing	d. drawing conclusions
e. making a table	e. generalizing
f. factorials	f. applying

IV. Materials
5-6 packages of regular flavored Life Savers
colored pens or pencils
5-6 school balances and stacking masses

V. Key Question
What color Life Saver appears more frequently in a roll than any other?
Life Saver Challenge: Given 5 Life Savers, each of a different color, how many different arrangements could be made?

VI. Background Information

1. Life Saver rolls contain 11 pieces of candy in a variety of arrangements of five colors and flavors. Most, but not all, packages have the same distrubution of colors. If packages are purchased from different stores, there is greater likelihood of variety in colors and numbers.
2. Each Life Save weighs less than a gram so students will have to weigh more than one to make a gram.
3. Each Life Saver has 9.7 calories.

VII. Management Suggestions
Students work well in small groups of 4-5

VIII. Procedure

1. Predict and record: number of colors and flavors, number of Life Savers per roll, number of calories and grams per piece.
2. Carefully unwrap the roll, and record the sequence of colors from left to right. Record the color of each piece and assign an appropriate letter.
3. Record observations about the colors and flavors in your roll. For example, Red is the most frequent color in my roll of Life Savers.
4. Make a hypothesis about other rolls of Life Savers (based on your own).
5. Test the hypothesis by collecting information for 6 rolls of Life Savers. Use the rolls and information generated in the classroom.
6. Make a graph that shows the distribution of colors of Life Savers for your own roll and the remaining five rolls. Summarize the graph by writing two true statements from the data shown.
7. State your conclusion regarding your hypothesis.
8. Try the Life Saver Challenge!! Given 5 Life Savers, each of a different color, how many different arrangements or mini-rolls of Life Savers could be made? Begin by making a prediction of the number of arrangements. Follow the described procedure on the activity page, Life Saver Challenge I, and the discussion suggested under IX. You may also wish to encourage students to picture the arrangements to help solve the problem as described in Life Saver Challenge II. Begin with two colors.

Sketch and identify all arrangements. Choose three colors. Draw or sketch all the different arrangements. Choose four colors. Draw or sketch all the arrangements. Make a chart or T-table that shows the number of colors relative to the number of arrangements.

No. of Colors	No. of Arrangements	Helping Chart
1	1	1X1=1
2	2	2X1=2
3	6	3X2X1=6
4	24	4X3X2X1=24
5	120	5X4X3X2X1=120
6	720	6X5X4X3X2X1=720

Analyze the chart by looking for a pattern. A true identifiable pattern doesn't emerge until more than 4 cases appear. The numbers become cumbersome in which case the teacher may have to introduce the idea of using a computer program to generate the subsequent numbers to recognize a pattern or simply show the idea of factorials. 4! (read 4 factorial) means 4X3X2x1=24. (See a suggested hint for procedure in Discussion).

IX. Discussion

1. Discuss the idea that many times a problem that seems too difficult to answer may be made simpler by "cutting it down to size" or wishing for a smaller number. In this case arranging 5 Life Savers in all the possible arrangements seems overwhelming. (There are 120 of them!!) So we begin with the idea of one Life Saver, then two and so forth, each time recording the results in a table. The pattern that emerges helps us to recognize the next solution. This pattern is difficult and not easily recognized by most students. Consequently, we have included the information for 5 and 6 colors so that students may see the pattern and test the idea of factorials.
2. A suggested approach that provides a hint: If I have two Life Savers of different colors, how many color choices are there for the first position? (two) After the first postion is filled, how many choices are left for the second position in the same arrangement? (one)

Two Colors:

No. of choices	(2)	(1)	(2)
	1st position	2nd position	Total Arrangements

If I have three Life Savers of different colors, how many color choices are there for the first position? (three) After the first position is filled, how many choices are left for the second position in the same arrangement? (two) After the second position is filled, how many choices are left for the third position in the same arrangement? (one)

(continued on page 19)

______________________ Name

LIFE SAVERS

① Make Your Predictions:

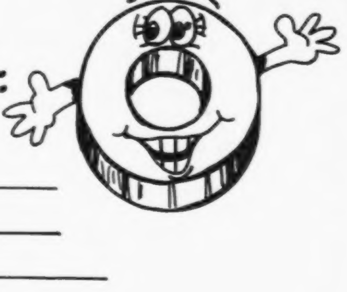
- How many flavors? ____________
- How many colors? ____________
- How many pieces? ____________

How many calories each? ____________

How many grams per piece? ____________

	Color:	Flavor:	Guess how many:	Count:
1.				
2.				
3.				
4.				
5.				
6.				

② Carefully unwrap the roll of Life Savers and record the sequence of colors from left to right:



③ Record Your Observations:

- Most frequent color(s) ____________, ____________
- Least frequent color(s) ____________, ____________
- Only one ____________, ____________, ____________

Name ______________________

LIFE SAVERS (CONTINUED)

④ Make a hypothesis about other rolls of Life Savers.

Example: I think that red will be the most common color in 5 out of 6 rolls of Life Savers.

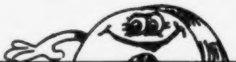
My hypothesis: ______________________

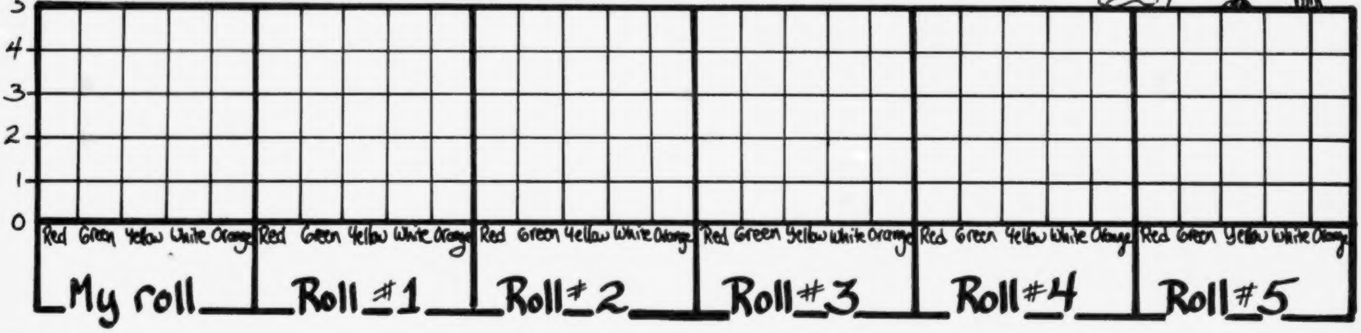
⑤ Gather Data: Record how many of each color.

	Red	Green	Yellow	White	Orange	Total
My roll:						
Other rolls #1						
#2						
#3						
#4						
#5						

⑥ Make a Graph:

Display your gathered data.




5
4
3
2
1
0
Red Green Yellow White Orange
My roll
Red Green Yellow White Orange
Roll #1
Red Green Yellow White Orange
Roll #2
Red Green Yellow White Orange
Roll #3
Red Green Yellow White Orange
Roll #4
Red Green Yellow White Orange
Roll #5

⑦ Summarize the graph by making 2 true statements:

1. ______________________
2. ______________________

⑧ Conclusion (or) Test the Hypothesis: ______________________

____
Name

LIFE SAVERS

CHALLENGE I

Key Question: Given 5 Life Savers, each of a different color, how many different arrangements, or mini-rolls, of candies could be made?

I predict ________ arrangements.

Make it Simpler... Make a Table...

# of Life Savers	# of Color Choices in each Position					Total # of Arrangements
1	① 1st position					1
2	② 1st	① 2nd				______
3	○ 1st	○ 2nd	○ 3rd			______
4	○ 1st	○ 2nd	○ 3rd	○ 4th		______
5	○ 1st	○ 2nd	○ 3rd	○ 4th	○ 5th	______

Observing & Generalizing

- How are the numbers related to their neighbors? ______________
____
- The total number of arrangements may be found by ______________
____

Try

8 ○○○○○○○○

11 ○○○○○○○○○○○

____
Name

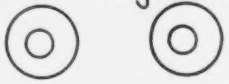
LIFE SAVERS

CHALLENGE II

PICTURING IS A PROBLEM SOLVING STRATEGY

TWO colors: ________ and ________

1st Arrangement



____ ____

Sketch and color all other arrangements.

Predict: How many more? _____ Total? _____

Three colors: ______, ______, and ______

1st Arrangement

____ ____ ____

Sketch and color all other arrangements.

Predict: How many more? _____ Total? _____

Four colors: _____, _____, _____, and _____

1st Arrangement

____ ____ ____ ____

Sketch and color all other arrangements.

Predict: How many more? _____ Total? _____

Make a T-Table or chart:

Look for a pattern. Try to explain how you could obtain the number of arrangements for any number of colors.

____

____

____

____

#of colors	#of arrangements
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

PINEAPPLE "EYE"STIMATES

(Grades 3-4)

I. Topic Area
Plants - Pineapple

II. Introductory Statement
Students will become more familiar with pineapples...physical characteristics-number of eyes.

III. Math Skills
- a. Estimating
- b. Graphing
- c. Counting
- d. Averaging
- e. Determining Range

Science Skills
- a. Observing
- b. Predicting
- c. Gathering Data
- d. Recording Data
- e. Interpreting Data

IV. Materials
For each group of 4 students:
One pineapple
Different colored pens or different colored clay to assist in keeping track or counting.

V. Key Question
"How are pineapples similar yet somewhat different?"

VI. Management Suggestions
1. Estimated time for activity: 30 to 45 minutes.
2. This activity requires a class graph for the total number of leaves.
3. Copy student worksheets.

VII. Procedure
1. Talk about the various parts of the pineapple (see fact page).
2. Pass out student worksheet and review it.
3. Each group of four should select a pineapple.
4. Students decide on a name for their pineapple.
5. Group members will use their senses to describe and illustrate their pineapple on the student worksheet.
6. Students will estimate the number of eyes on their pineapple.
7. Students may use colored pens or colored clay to keep track of the eyes counted.
8. Students count and record data on student worksheet.
9. Students will graph the number of eyes on the worksheet.
10. Students will estimate the number of leaves on the crown then count and record data on the student worksheet.
11. Students will graph the number of leaves on the crown.
12. Discuss the results of the total class observations-number of eyes, leaves, ranges and averages.
13. Each group will record data on the class chart.
14. Discuss results.
15. Complete the rest of the student worksheet.

VIII. What the Students will do (see section VII.)

IX. Discussion
1. Did your pineapple have more similarities or differences as compared to other pineapples?
2. Discuss the findings on number of eyes and number of leaves.
3. What was the range of the numbers of eyes.
4. What was the range of the numbers of leaves.
5. What was the total class average on the number of eyes?
6. What was the total class average on the number of leaves?

X. Extensions
1. What kinds of patterns do you see emerging? Eyes? Leaves?
2. Why did they name the fruit pineapple?
3. Would the pineapple diet be safe? (Consume only pineapples)
4. When is the best time to buy a pineapple?
5. Would a fresh pineapple taste any different from a week old pineapple or canned pineapple?
6. How do you select a sweet pineapple.
7. How much acid is in a pineapple? (acid content)
8. What percent of the pineapple is edible?
9. Where do the skin, crown and core go after the pineapple company cans the fruit?
10. Beat the pineapple with the skin on and remove one of the eyes at the base. Insert the straw into the hole at the base and drink.

IX. Curriculum Coordinates Art
1. Make pineapple rubbings.
2. Halloween-carve Jack-o-lanterns from pineapples.

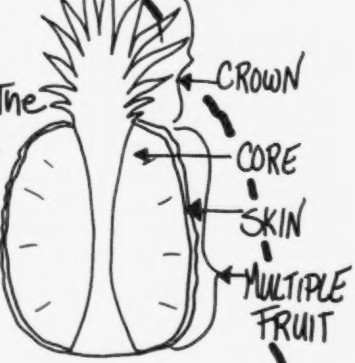
(Life Savers continued)

Three colors:

	1st position	2nd position	3rd position	Total Arrangements
No. of choices	(3)	(2)	(1)	(6)

Continue to develop this idea until students see that in each position the number of choices declines by one and that ultimately we find the product of all the numbers to determine the number of arrangements. If one multiplies the number in each position by its neighbor on the right beginning with the first position and continuing from left to right we arrive at a product that is called a factorial and that it represents all the possible arrangements given a finite number of different color choices.

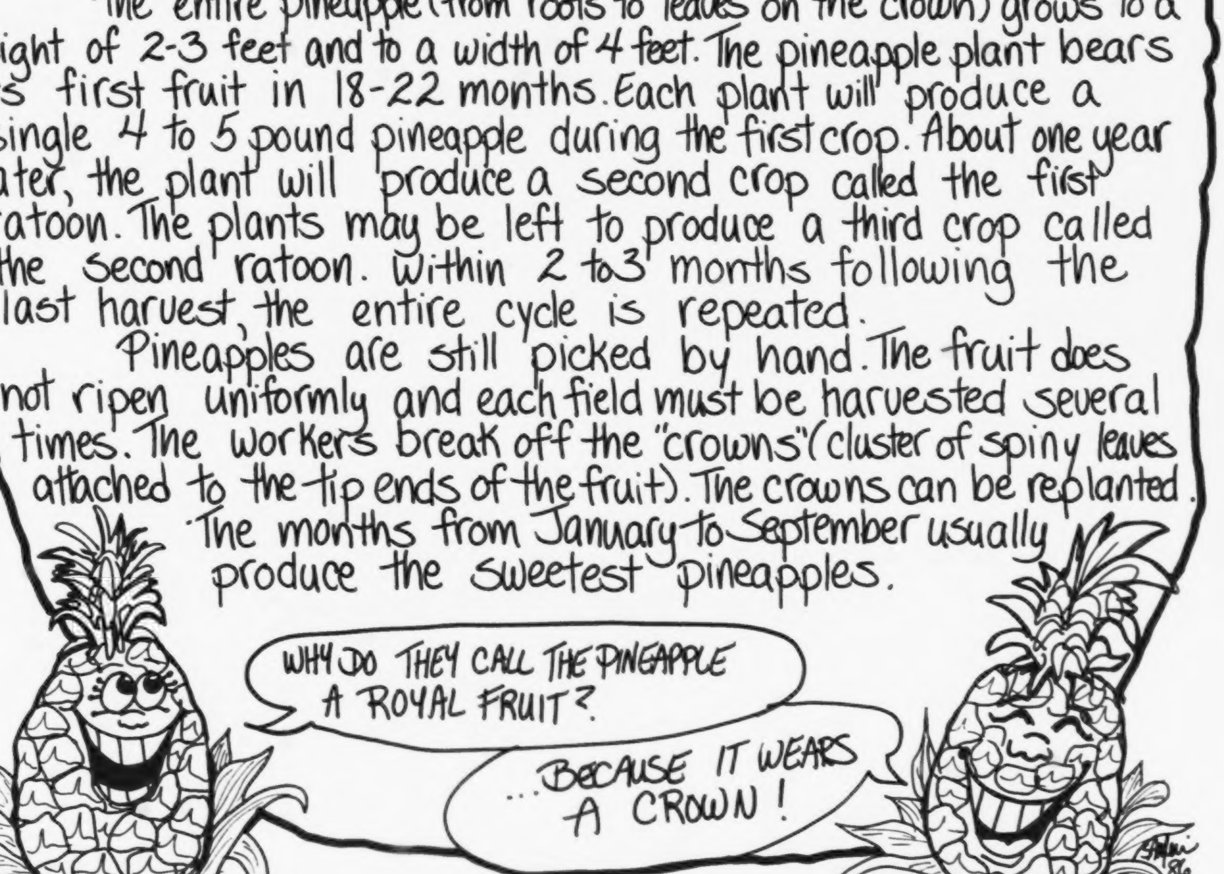
Pineapple Facts

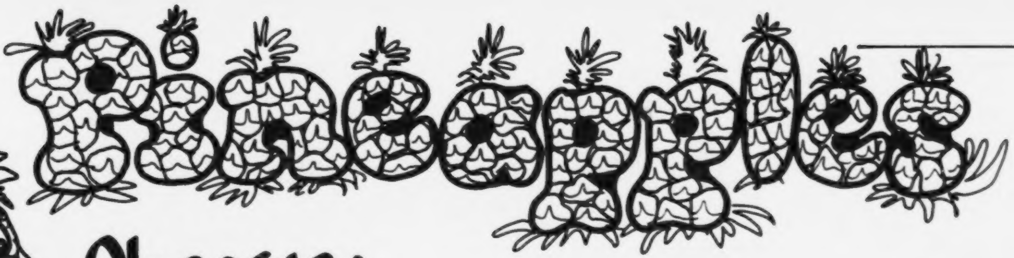


There are 4 major parts of the pineapple. The crown has approximately 30-40 stiff sword-like leaves that center around a thick stem. Twelve to fourteen months after planting, the inflorescence (flower stalk with tiny flowers attached) appears in the center of the stem. This inflorescence looks like a small pinkish-red bud. From this bud, blue-violet flowers bloom in a spiral pattern beginning at the base and moving upward. Each flower blooms for one day and all flowers bloom within 14-20 days. These flowers develop into fruitlets. These fruitlets unite with the stalk and form the yellow center or core of the pineapple.

The entire pineapple (from roots to leaves on the crown) grows to a height of 2-3 feet and to a width of 4 feet. The pineapple plant bears its first fruit in 18-22 months. Each plant will produce a single 4 to 5 pound pineapple during the first crop. About one year later, the plant will produce a second crop called the first ratoon. The plants may be left to produce a third crop called the second ratoon. Within 2 to 3 months following the last harvest, the entire cycle is repeated.

Pineapples are still picked by hand. The fruit does not ripen uniformly and each field must be harvested several times. The workers break off the "crowns" (cluster of spiny leaves attached to the tip ends of the fruit). The crowns can be replanted. The months from January to September usually produce the sweetest pineapples.


WHY DO THEY CALL THE PINEAPPLE A ROYAL FRUIT?
... BECAUSE IT WEARS A CROWN!



Pineapples

_______________ "Eye"stimator

1. Observe:

Describe your pineapple:

____

____

____

____

____

2. Draw your pineapple

3. Look again.

Feel the eyes. Draw a close-up of one of the eyes.

How many eyes do you think it has? Prediction: ______

Count the eyes. How many? Actual : ______

How close was your guess? Difference: ______

4. Take another look!

Draw a detail of one leaf from your pineapple. Color it.

How many leaves do you think it has? Prediction: ______

Count the leaves. How many? Actual: ______

How close was your guess? Difference: ______

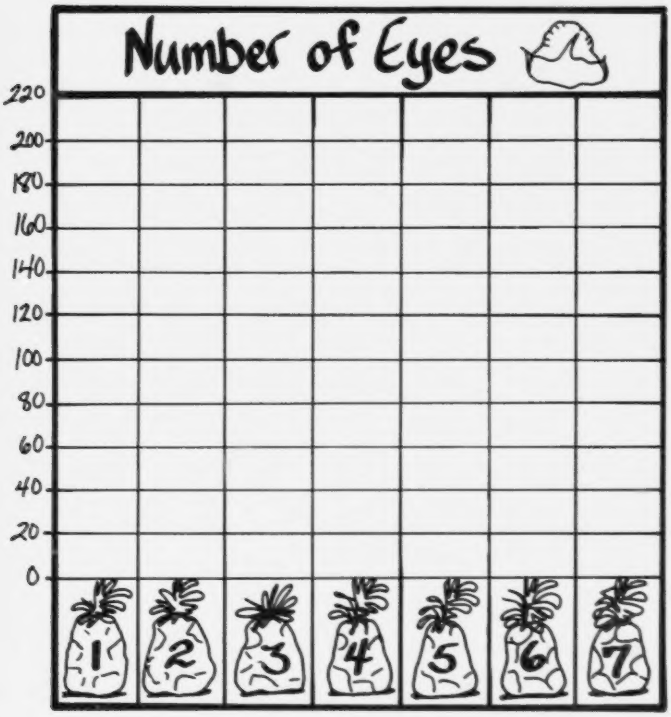
______________ "Eye"stimater

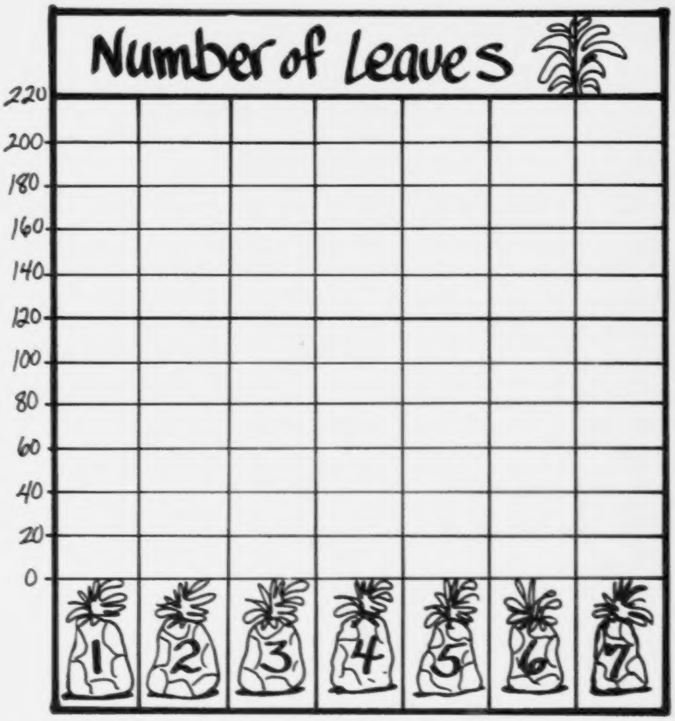
Pineapples

5. Gather Data:

	Pineapple #1	Pineapple #2	Pineapple #3	Pineapple #4	Pineapple #5	Pineapple #6	Pineapple #7
Number of Eyes							
Number of Leaves							

6. Display Data:





7. Analyze Data:

- What is the range of pineapple eyes in your class?
  highest: ________ lowest: ________ difference: ________
- What was the average number of pineapple eyes? Average: ________
- What was the range of pineapple leaves in your class?
  highest: ________ lowest: ________ difference: ________
- What was the average number of leaves? Average: ________

DA Perfect Pineapple

_______________ Quality Control Manager

Circumference

Estimate . . . . I think the greatest circumference of the pineapple will be ______ cm.

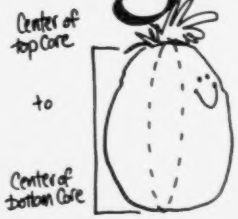
Measure . . . . I measured and the greatest circumference was ______ cm.

Find Difference There was a difference between my estimate and the actual of ______ cm.

CENTIMETERS

ESTIMATE															
ACTUAL															
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60

Height



Estimate . . . . I think the height of the pineapple will be ______ cm.

Measure . . . . I measured and the actual height of the pineapple was ______ cm.

Find the Difference There was a difference between my estimate and the actual of ______ cm.

CENTIMETERS

ESTIMATE															
ACTUAL															
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60

Mass

Estimate . . . . I think the pineapple will weigh ______ grams.

Weigh . . . . I weighed the pineapple and its actual mass was ______ grams.

Find Difference. There was a difference between my estimate and the actual of ______ grams.

GRAMS

ESTIMATE															
ACTUAL															
	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000

Integrated Math- Science Workshop

Judith A. Hillen

In response to an ever increasing demand for upgrading instruction in mathematics and science, the Fresno Pacific Math Science Project and the AIMS Education Foundation are offering hands-on math/science workshops for summer 1987 to be held on the Fresno Pacific College campus and eight other selected sites in California, Oregon and Washington.

The integrated math/science workshops offered on the Fresno Pacific College campus will be held at four separate times during the summer program. The dates include: June 15-19, July 6-10, July 13-17 and August 3-7. Each workshop will consist of approximately 50 hands-on investigations drawn from the physical, biological, and earth sciences. Each day will begin with two one-hour discussion sessions centered on topics of general interest to the classroom teacher. Such topics include: Science Process Skills and the State Frameworks, the Math Model, Managing the Hands-On Classroom, Cooperative Learning and AIMS, A Closer Look at Scientific Method, Estimation and Graphing Techniques, Integrating Disciplines, Evaluation and Testing, and Setting Up an AIMS Classroom. A major portion of the day will focus on grade level specifics through hands-on activities within a well-defined range of sessions for grades K-2, 3-5, and 6-9. Participants must register for one grade level strand.

The instructional team will be headed by Dr. Arthur Wiebe and Judith Hillen, Directors of Project AIMS. Sharing the leadership responsibilities will be a team of well-trained and experienced AIMS National Leadership Leaders. Together they will share their expertise in helping participants incorporate Project AIMS into the classroom, adapt the activities to appropriate grade levels, extend the activities into other curricular areas, and correlate the lessons to the California science and math frameworks. Make It, Take It sessions, Lab Experiences and Computer Simulations may be offered where appropriate.

The basic fee for the one week workshop is $170 which includes all materials used in the workshop, but no college credit. Two credit options are available: Graduate credit and In-Service credit. The added cost to two semester units of Graduate credit is $40 for a total fee of $210. The added cost for 2 semester units of In-Service is $20 for a total of $190. All participants under either arrangement will receive without added cost their choice of three Project AIMS publications. Since the Student pages have duplication rights for making up to 200 copies, this means that sufficient materials will be included to begin the program in the local schools.

Because the total number of participants in each workshop is limited, it is wise to pre-register early to avoid disappointment. A pre-registration form is included here. Each section must be complete in order for final reginstration to be processed.

1987 PROJECT AIMS WORKSHOPS PRE-REGISTRATION

ALL information requested below must be supplied before this pre-registration can be accepted and processed. Full registration and housing information will be mailed upon such acceptance.

Name ______________________ Soc. Sec. No. ____________

Street ______________________ City ____________

State ____________ Zip ____________ Home Phone (_____) ____________

School District ______________________

School ______________________ School Phone (_____) ____________

1. Please enroll me in (choose one):
   - ☐ AIMS Workshop I, June 15-19
   - ☐ AIMS Workshop II, July 6-10
   - ☐ AIMS Workshop III, July 13-17
   - ☐ AIMS Workshop IV, Aug. 3-7

2. (choose one):
   - ☐ Not for credit ($170)
   - ☐ In-Service credit ($190)
   - ☐ Graduate credit($210)

3. Select one grade level strand: ☐ K-2 ☐ 3-5 ☐ 6-9

4. Do you wish information regarding On-Campus Housing? ☐ Yes ☐ No

Please return registration form to:

Judith Hillen, Project AIMS Director, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702

For Office Use Only

Date Received: ____________ Processed by: ____________

Copy sent to: ☐ Registrar ☐ In-Service ☐ Business Office ☐ Housing

Phone Home

I. Topic Area

Space voice communication and recognition of geometric shapes.

II. Introductory Statement

The students will experience how space voice communication worked early in the space program, will familiarize themselves with geometric shapes, learn to give clear instructions, and practice careful listening to one of their peers.

III.

Math Skills	Science Processes
Recognizing geometric shapes	Communicating
	Observing
Recognizing relative positions	Measuring and comparing
	Applying and generalizing
Computing percentages	
Division	
Constructing geometric shapes	

IV. Materials

Geometric shapes (either cut out of pattern or constructed shapes).
Small ziplock baggies or paper envelopes
Student worksheets
Two 8½"x11"sheets of paper or sheets of construction paper for each team
Sicissors, crayons, and compass (optional)
Overhead projector (optional)
Colored plastic shapes for overhead (optional)

V. Key Question

If you were an astronaut in a space ship, how could you repair malfunctioning functioning equipment with instructions coming from mission control?

VI. Background Information

Early in the space program, it was necessary to rely entirely on voice communication to give and receive instructions. This is still true in some settings. A special skill is involved in being able to give precise and clear instructions, to listen with care, and to follow such instructions accurately.

VII. Management Suggestions

1. This experiment may take 2 or 3 days to complete, depending upon whether or not students learn to construct the shape. The teacher has the option of letting the student draw their shapes or having them cut the ones already provided.
2. With younger children, it might be easier to have the shapes already made and placed in the baggies. If you have the shapes made in advance, start with day 2 of the procedure.
3. Each student team must have two identical sets of shapes, one for the astronaut and the other for the mission control officer. Eight different shapes are included for this lesson. Congruent shapes should be colored the same. The emphasis is on shape recognition rather than differentiating color. If the atribute of color is also to be used, than each set of shape must be produced in several colors.

VIII. Procedure

Day 1

1. If you are making your own shapes, have the students follow the directions for construction provided. Make sure that the partners in a team draw the same size shapes and color them the same.
2. Have the student teams cut out the shapes and place them in baggies or envelopes. Each baggie should have two of each size, shape, and color.

Day 2

3. Have the pair of students decide which one of the two will be the mission control officer and who will be the astronaut.
4. Pass out the baggies. Have each team divide the shapes so that each has a set of congruent shapes. Provide each team with two instrument panels (8½"x11" sheets or sheets of construction paper).
5. After the students have their shapes ready, take the students through the following practice run of directions or a similar series. The teacher or a student who has been briefed can be the mission control officer for this exercise. All other students play the role of astronauts. When giving these instructions during this practice session it might be helpful to display the shapes on the overhead projector so that the students can look at yours to see if they have placed theirs correctly. In these instructions it is assumed all students have figured with the same color configuration.

Astronaut Jane:
Place your rectangular instrument panel in front of you so the longer side of the rectangle is at the bottom. Place the large blue square in the upper left hand corner of the instrument panel.

Astronaut Jane:
Place the small yellow circle in the middle of the blue square.

Astronaut Jane:
Place the large green rectangle along the right side of the blue square so its longer side touches the top of the instrument panel.

Astronaut Jane:
Place the large red circle so it is tangent to the large green rectangle at the mid-point of its base.

Astronaut Jane:
Place the small green hexagon in the center of the circle.

Astronaut Jane:
Place the large red hexagon in the lower right hand corner of the instrument panel so one side rests on the bottom of the rectangle.

Astronaut Jane:
Place the small ellipse in the center of this large hexagon.

Astronaut Jane:
Place the small blue rectangle along the top side of the hexagon so it touches the right side of the instrument panel.

6. After you have finished giving directions, have the students answer the top part of their worksheet.
7. Now have the students sit back to back with their shapes in front of them. The student who is mission control will be giving directions to the student who is the astronaut. The first time the astronaut may not ask questions of mission control. When repeating the procedure, the students may ask questions of each other. It may be helpful to have the students say their name when giving directions to the other student.
8. Give the students a time limit of between 5 to 10 minutes. At the end of the time limit, have the students stand up and see how many shapes were correctly places.
9. Have students fill out their worksheets as they go. After everyone is finished answer the question on the student worksheet.

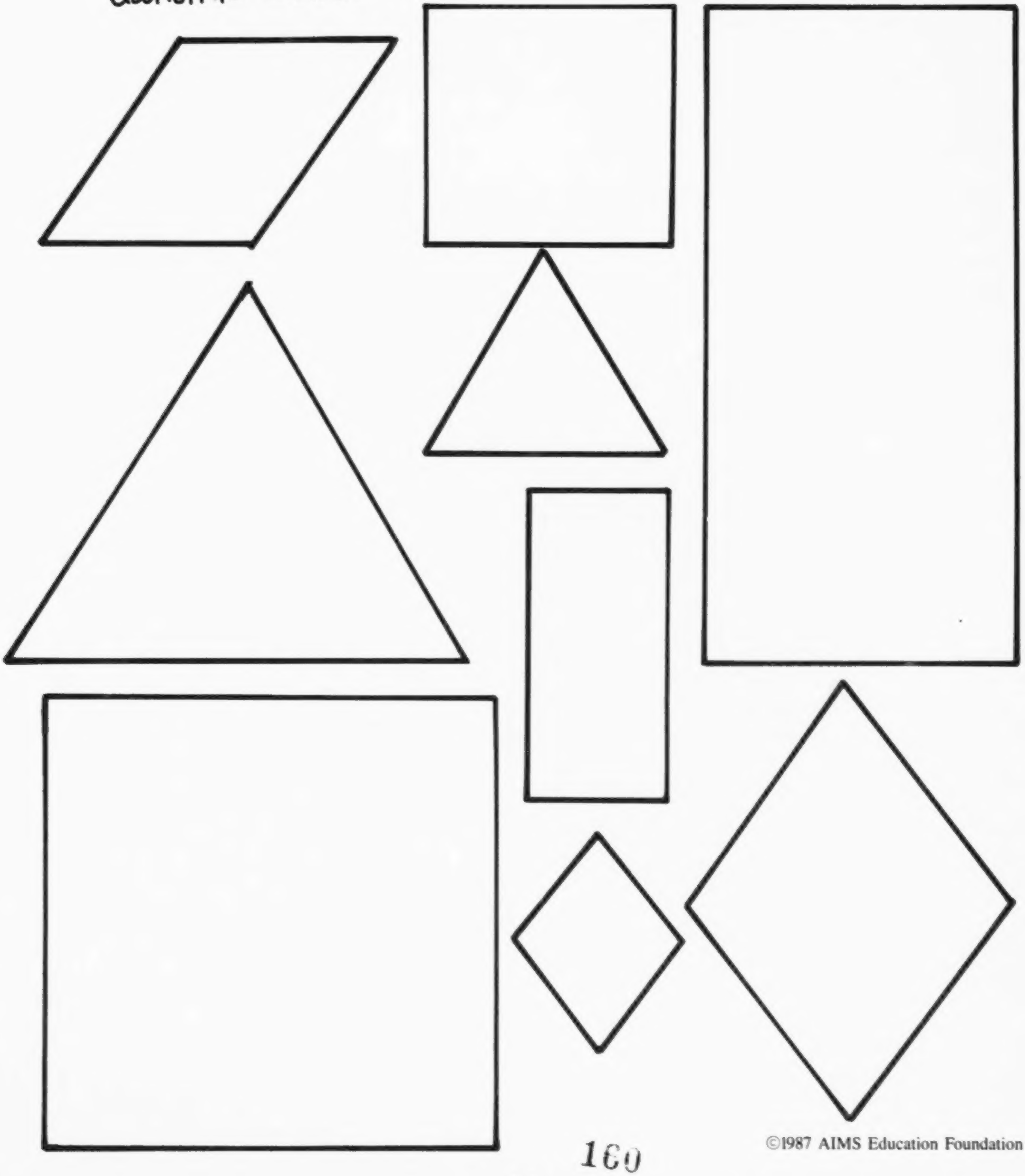
IX. Discussion

You may explain to the students that when the space program first began the astronauts did not carry television camaras on the ships. Mission control and the astronauts communicated without seeing each other, just by voices, so it was very important that the information given were correct and in detail.

1. Is it important to have good communication between mission control and the astronauts?
2. How do we benefit in our everyday life from the improvement in communicatin that have been made because of the space program?

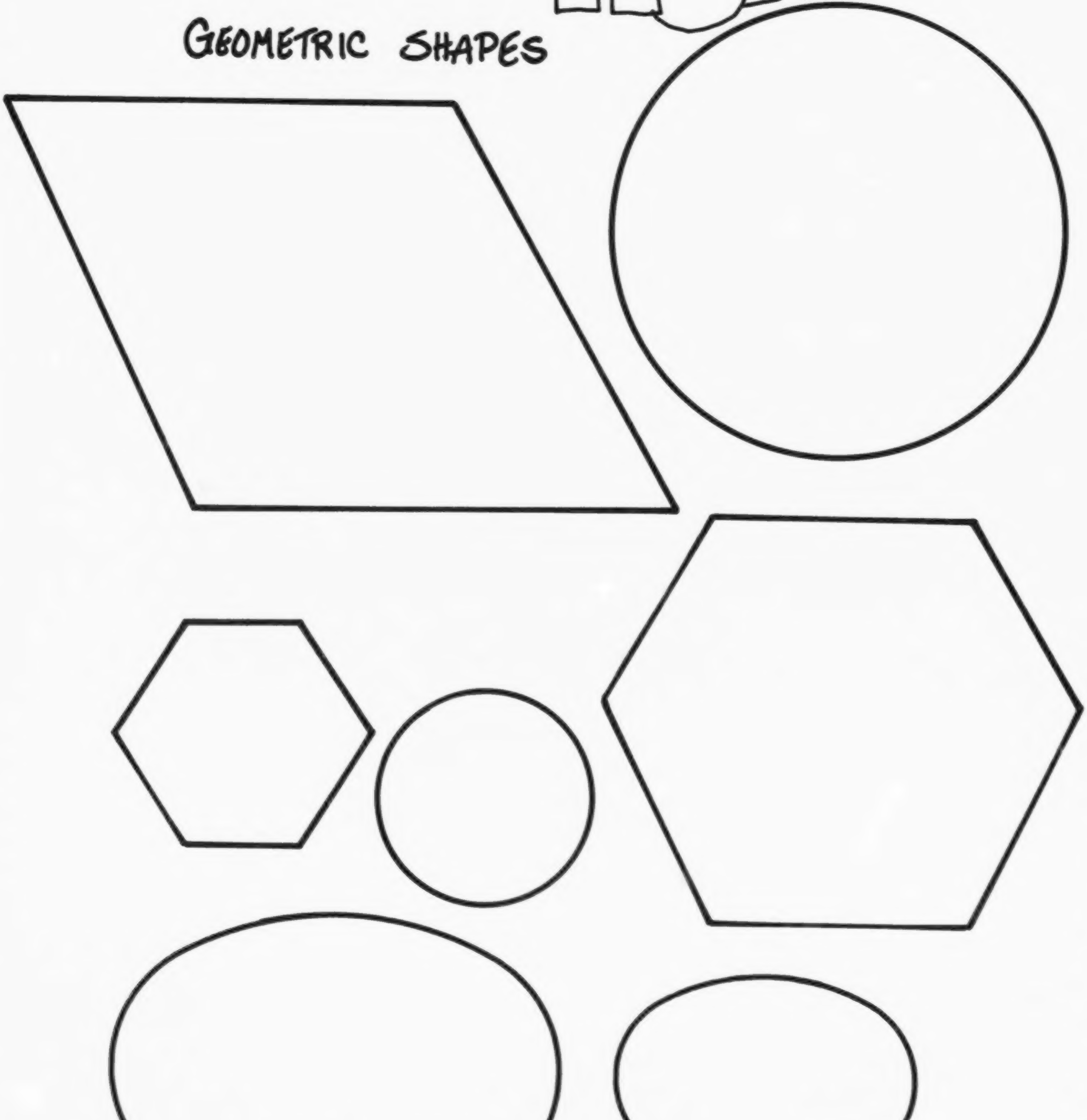
PHONE HOME

GEOMETRIC SHAPES



PHONE HOME

GEOMETRIC SHAPES



PHONE HOME

Astronaut: ____________________
Mission Control: ____________________

1. You are an astronaut receiving instructions. Listen to the directions carefully. Try to place your shapes correctly without asking any questions.

My Results

# of Shapes Right	Total # of Shapes	Percentage of Accuracy
÷	=	

2. Next, work with a partner. Take turns being the astronaut and Mission Control. Listen to your partner's instructions and try to place your shapes correctly without asking questions. Record each person's results as the astronaut.

WITHOUT QUESTIONS

My Results

# of Shapes Correct	Total # of Shapes	Percentage of Accuracy
÷	=	

PARTNER'S Results

# of Shapes Correct	Total # of Shapes	Percentage of Accuracy
÷	=	

3. Try it ave more time. This time, you may ask questions when given directions. Record each astronaut's result's.

WITH QUESTIONS

My Results

# of Shapes correct	Total # of Shapes	Percentage of Accuracy
÷	=	

Partner's Results

# of Shapes Correct	Total # of Shapes	Percentage of Accuracy
÷	=	

Astronaut: ______________________

PHONE HOME

Questions?

1. Who had the highest percentage of accuracy? ______________

2. How many figures did you place correctly?
Trial 2: __________ Trial 3: __________

3. On a scale of 1 to 10, how hard was it to be Mission Control?

1 — — — — 5 — — — — 10

4. On a scale of 1 to 10, how hard was it to be the astronaut?

1 — — — — 5 — — — — 10

5. Which of the two was harder for you? ______________
Why? ______________

6. On a scale of 1 to 10, how hard was Trial 2? (no communication)

1 — — — — 5 — — — — 10

7. On a scale of 1 to 10, how hard was Trial 3? (with communication)

1 — — — — 5 — — — — 10

8. Which did you like better, being Mission Control or being the astronaut? Why? ______________
____

9. What would you do to make communication better between the astronaut and Mission Control? ______________
____

HOW A PLANT CARRIES WATER

GENERAL INFORMATION

Vascular plants have vessels that conduct water and nutrients from the soil through the stems to the leaves. Non-vascular plants, such as mosses, liver worts and horn worts, absorb water directly through their leafy portions.

The roots of most vascular plants are covered by microscopic root hairs which greatly increase the water-absorbing surface of the root. (When transplanting, it is important to leave the roots as undisturbed as possible to avoid tearing off the fragile root hairs. If the root hairs are destroyed in sufficient number, the plant will die because it is unable to absorb the water in the soil.)

From the root hairs, water passes to the "xylem" and flows up the stem to the leaves where much of it is lost (about 90%) by a process known as *transpiration*. Mature corn plants transpire about 30 liters (8 gallons) of water per week. At this rate, an acre of corn may transpire as much as 1,325,000 liters (350,000 gallons) of water in an average growing season which is approximately 90 to 100 days. An average size birch tree will transpire from 750 to more than 3,785 liters (200-1000 gallons) of water per day during the growing season. (The hotter the day, the more water will be lost.) If the human requirement for water were similar to that of plants, each adult would have to drink well over 38 liters (10 gallons) of water per day. Since humans have a closed circulatory (vascular) system, much of the water we consume is recycled.

Plants require a vast amount of water for various reasons. These include: (1) providing a medium for chemical reaction which results in growth, (2) giving structure to non-woody plants, such as the celery plant, and (3) cooling the leaf surfaces during the warm growing season.

The subject of how water moves from the roots to the leaves, against gravity, has been cause for much debate. The most satisfactory explanation of this process, suggested so far, is the cohesion-tension-transpiration theory. The process of water movement through a plant is highly complicated. Simply stated, the transportation of water from the leaf to the external atmosphere causes a force which pulls the water from the xylem to the leaf.

MATERIALS

This activity can be conducted by students at home a day or two prior to when celery is going to be included in a family meal. After conducting the investigation, the celery can be used in cooking or eaten raw—the food coloring is safe to eat.

Use a tall, clear glass so the results of the experiment can be easily seen.

PROCEDURE

1. Use 4 or 5 drops of food coloring in a 12 ounce glass of water.
2. After cutting off the bottom of the celery stalk, examine the end of the stalk. Use a magnifying glass if available, but even without the aid of a magnifying glass the xylem can easily be seen between the ridges of the stalk.
3. Place the celery in the glass and mark the water level with a piece of masking tape.
4. The results will begin to show after approximately one hour; however, if the investigation is started in the morning and resumed a few hours later in the afternoon, students will be able to see more dramatic results.
5, Cut across the celery stalk about one-half inch from the bottom. Depending on how long the celery was in the water, you can slice it every one-half inch and let the students examine the results.
6. As an art integration lesson, have the students illustrate what they see when examining the celery stalk.
7. Have students bring white flowers from home and repeat procedures 1 through 6.

POSSIBLE ANSWERS

1. Leave the celery stalk in the colored water for about 24 hours. Remove it and slice it into one-half inch strips. Compare these with strips cut from a stalk that was not in the colored water. Students will find that the xylem can be seen in both stalks. They are different only in that the stalk in the colored water has colored streaks up the stalk and into the leaves.
2. Answers will vary, but students should understand that plants carry water to the leaves through tiny tubes in the stem.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Have students examine several stalks of celery. Does each stalk have the same number of xylem? Does each stalk have the same number of ridges?

Conduct a follow-up investigation by using two glasses of water. Color the water in one glass blue and in the other glass red. Slice the celery stalk up the center about three-fourths of the way to the leaves. Place one-half of the stalk into the glass with the blue water and the other half into the glass with the red water. Leave for several hours and observe. After removing the celery from the glasses, cut across the stalk near the leaves. Do the colors blend or is there evidence of separate red and blue xylem?

Select a large celery stalk and weigh it using a balance scale. Record its weight and then slice it into very thin strips and allow it to dry for several days. Weigh it after all of the water has evaporated to determine what percent of the celery is water.

How a Plant Carries Water

• Materials:

Fresh celery stalks with leaves
Glass of water
Red food coloring

• Procedure:

1. Place several drops of red food coloring in a glass of water.
2. Cut off bottom of stalk of celery.
3. Place celery stalk in glass of colored water.
4. After about an hour, remove celery from water.
5. Break celery in middle and observe.
6. Draw a picture of what you see:

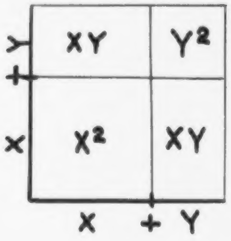
7. Try the same experiment with white flowers like daisies or carnations. Use different colors of food coloring.

• Questions:

1. Compare a fresh stalk of celery to the stalk in the glass of colored water. How are they alike? How are they different?

2. What have you observed about how the stalk of a plant carries water to the leaves?

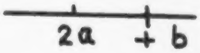
(Connectors continued)



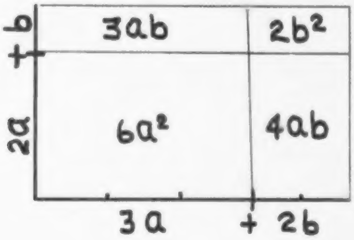
The rectangles for the sum and the components are completed. Next, the components are multiplied to find the area of each region.

Finally, the products are added: $x^2+2xy+y^2$

A second example finds the product of $(2a+b)(3a+2b)$. The respective sums are:



The rectangular regions are formed and the area of each computed.



Finally, the results are added: $6a^2+4ab+3ab+2b^2 = 6a^2+7ab+2b^2$

What began with the simple concept that multiplication means to place one length perpendicular to another results in giving meaning to a broad span of mathematical applications.

In the next issue, the operations of subtraction and division will be examined.

Fresno Pacific Math-Science Project
announces the

1987
SUMMER PROGRAM

designed for

- ★Elementary Teachers of Mathematics and Science
- ★Secondary Mathematics Teachers
- ★Computer Education Teachers
- ★Teachers Using Computer Software
- ★Curriculum Coordinators

FESTIVAL OF MATHEMATICS

June 22-July 3, 1987

Faculty: Lola May, Stanley Bezuszka, Judie Hillen, Larry Ecklund, Arthur Wiebe, Jonathan Knaupp, Valerie Welk, Wilbert Reimer, Jim Wilson, Fran Threewit, Kay Fletcher, Dave Youngs

COMPUTER INSTITUTE

July 6-17, 1987

SCIENCE FESTIVAL

July 20-31, 1987

Faculty: Verne Rockcastle, Joe Abruscato, Del Alberti, Gilbert Yee, Dennis Schatz, Kim Sutton, Dave Youngs, Mike Woods, Ted Ostrander, Arthur Wiebe

INTEGRATED MATH-SCIENCE (AIMS) WORKSHOPS

AIMS I-June 15-19 ★ II-July 6-10 ★ III-July 13-17
IV-August 3-7

Fresno Pacific Math-Science Project
Fresno Pacific College
1717 South Chestnut Avenue
Fresno, California 93702
(209)453-2024

These programs meet the requirements for the use of PL 98-377 funds.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation

Volume 1, Number 6 January, 1987 ©AIMS Education Foundation

AIMS On Target In China

Chinese Students Measure Up

Rose Lee Patron

Teaching in China last year was an experience that not only gave me insight to a completely different culture, language and people but also provided me the opportunity to apply many of the teaching theories, methods, and techniques that I had acquired during the previous eight years.

First of all, let me describe the educational environment and practices so that you will able to fully appreciate the story I have to tell.

Guangdong Foreign Languages Normal School is a teacher's training college for approximately one thousand students who have qualified to attend through competitive examinations from Guangdong province. The college includes a four year middle school and a three year college. Most students begin as middle school students and by means of highly competitive yearly academic examinations continue on to the college level.

To increase the oral and aural English abilities of one hundred fifty of the first year college students who are destined to be English teachers in China was my initial task. These students have had six years of English from native Chinese teachers; therefore their reading and writing abilities are very proficient but their oral language proficiency is poor.

Also, the prevalent method of teaching in China is through rote memory. Students are trained to memorize and repeat lessons beginning in the very early years of education, and they perform extremely well this way. However, in the area of critical or creative thinking it's a different story.

Chinese teachers put students on the spot by calling them individually to recite or to respond to questions. Peer pressure is very prevalent and making a mistake or not knowing the correct response draws ridicule and/or laughter. Students are not accustomed to raising their hands or volunteering information (even if they know the answer!) unless asked to do so.

In contrast to the above method, one of the guidelines in second language teaching is to create a comfortable environment, lower the famous Kraschen affective filter, and allow students the freedom to express themselves at their own language ability level rather than focusing in on correct grammar and pronunciation. In other words, it's OK to make mistakes. Let's try to communicate.

Using cooperative learning techniques, second language acquisition methodology, lots of comprehensible input, and any other tricks I could pull out of the bag, I encouraged and challenged these bright students to speak up and out, communicate with each other in English, and try these very "strange and different" methods to improve their language abilities.

Having been one of the initial participants in the first production of the AIMS project, I was very much aware of this valuable resource and have always considered it not only a supplement for math and science curricula but also wonderful material for language development. In fact, I value it so highly I managed to transport most of my own personal collection of AIMS materials to China with me.

Using AIMS with these Chinese students, reluctant to step out of the mold, proved to be one of the most challenging and also one of the most successful methods I tried. Early in September, I had introduced TPR (Total Physical Response) to the students to assess and build on their vocabulary pertaining to body parts. This naturally led to one of AIMS' investigations called "How Do You Measure Up?" from the book, **From Head to Toe.**

What a task it was to encourage these students who had been disciplined all their educational lives to sit straight at their desk, face front, and assume an almost military attitude in a classroom to stand up, and move around, and to measure the length of each others arms, thumbs, head and neck circumferences, length of nose, etc., not to mention their big toes and ears. For some reason, the ears brought the greatest laughter and most resistance!

First they had to estimate, of course, and then, working with a partner they began to measure each other. Boys with boys and girls with girls only. These eighteen and nineteen year olds are also very inexperienced and very shy about even holding hands with the opposite sex, in great contrast to the liberal

(see China, Page 9)

Rose Lee Patron was a member of the National Science Foundation Funded AIMS program and a writer for Project AIMS. She received her master of arts from Fresno Pacific College. Currently, she is Project Coordinator of the Western Fresno County Title VII Consortium based at Kerman Unified School District, Kerman, California. She is a doctoral student at the University of San Francisco.

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California **93747**. Volume I, No. 6.

EDITORS . . . . Arthur Wiebe, Judith Hillen
STAFF ARTIST . . . . Sheryl Mercier
OFFICE MANAGER . . . . Sheryl Bishop
PROGRAM DIRECTORS:
Fresno Pacific College Math/Science Project . . . . Lawrence E. Ecklund
AIMS Education Foundation . . . . Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes . . . Ted Ostrander
Project AIMS . . . . Judith Hillen, Arthur Wiebe
Project SETUP . . . . Jim Wilson, Ted Ostrander
Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION
PRESIDENT . . . . Arthur Wiebe, Ed.D.
VICE-PRESIDENT . . . . Wilbert Reimer
SECRETARY . . . . Lawrence Ecklund
TREASURER . . . . Jon Hillen
ACCOUNTANT . . . . Robert J. Dwyer
STAFF ARTIST . . . . Sheryl Mercier

Red M&Ms are Back!

Red M&Ms, banished 11 years ago because of concern over food dyes, will once again join their place among the tan, brown, yellow, orange, and green M&Ms according to an announcement by the manufacturer.

The return of the red candies was prompted by a national outcry that included thousands of letters to the manufacturer.

About 20 percent of the 100 million M&Ms made each day will be red. The candy, a hard coating over a round chocolate center, was first made in 1941.

Red M&Ms contain Red Dye Nos. 3 and 40 which are considered safe.

Stores will begin to receive packages with red M&Ms in February, 1987.

Included in this issue is another M&M investigation. When it was designed the red sorting circle was included to show the empty set! It was not a prediction of what was to happen. But that inclusion means that the worksheet for sorting is useful whether or not red M&Ms are included.

SOLUTIONS AND COMMENTS

TOWER OF CUBES

Wilbert Reimer

(For this month's mathematics poster see Page 29. This poster is taken from Set E which is now being released.)

This problem requires students to visualize a three-dimensional structure (some cubes are behind and underneath others).

Students should count the cubes in structures with 3, 4, and 5 layers, enter these values in the table, and discover the emerging pattern. The differences for the numbers in the second column are 3, 6, 10, 15, 21, etc. (triangular numbers). This Level I discovery allows students to continue the table indefinitely. The numbers in the second column are **pyramid** numbers and are found in Pascal's Triangle.

The Level II solution can be found by using the formula, which students may have discovered earlier, for pyramid numbers. (See Pyramid Numbers Poster in Set C.) The formula for the value of the nth pyramid number is: $n(n+1)(n+2)/6$.

If students are not familiar with pyramid numbers we make the following suggestion: construct a helping column of the products of the number in the first column and the next two numbers in the first column. This is shown below.

Number of Layers	Helping Column	Number of Cubes
1	$(1)(2)(3)=6$	1
2	$(2)(3)(4)=24$	4
3	60	10
4	120	20
5	210	35
6	336	56
50	132600	22100
n	$n(n+1)(n+2)$	$\frac{n(n+1)(n+2)}{6}$

Lastly, students should discover that the numbers in the helping column must be divided by 6 to produce the value in the Number of Cubes column. The complete solution is shown in the above table.

Errata

In the December issue the mathematics poster was referred to as "How May Chords" in the "In Summary" description. It should have stated "How Many Diagonals" and relate it to polygons. The general result is the same, however: $n(n-3)/2$.

• THIS ISSUE • THIS ISSUE • IN SUMMARY • THIS ISSUE • THIS ISSUE •

AIMS in China

Rose Lee Patron used AIMS investigations to effectively teach English to first-year college students in China! Even now, some of these students write how much better they learned English with this approach. **See story on Page 1.**

Kay Fletcher, This Month's AIMS National Leadership Network Member

Kinder-AIMS! That's the name of Kay's program. **See story on Pages 4 and 5.**

Campbell Union School District AIMS High

Art Ring relates how Campbell has integrated AIMS into the science program. **See story on Page 6.**

The Study of Science Can Be Enriched

Judith Hillen discusses the implications of enriching science with a balanced emphasis on content, processes, and the development of positive attitudes. **See story on Page 8.**

AIMS at Science and Math Conferences

Judith Hillen, Arthur Wiebe, and members of the AIMS National Leadership Network will make numerous presentations at regional and national conferences. **See Page 9.**

Teddy Bears Come to a Tea Party

Lana Fricke discusses how she has integrated a strong language arts experience with AIMS. **See story on Page 10.**

"Out of This World, Book A" to be Published

The first of two solar system books entitled "Out of This World, Book A", is scheduled for release on February 25. The price is $10.95. **See Page 11.**

Science Festival Promises Rich Experience

The 1987 Science Festival is attracting strong interest. It promises to be a unique experience. Special laboratory experiences have been added. **See announcement on Pages 12 and 13.**

Teddy Bears Playing in the Den

This new AIMS investigation deals with the effectiveness of sampling, a basic activity in our contemporary society, in an interesting setting in which Teddy Bears are playing a game. **See activity on Pages 14-17.**

The Teddy Bears Go Sledding

In how many ways can Teddy Bears arrange themselves on a sled? Using plastic Teddy Bears or similar objects, students experiment with the result. **See Pages 18 and 19.**

M&M's Provide New Investigation

Not only are red M&M's reappearing, but a new AIMS investigation celebrates the return with this newly published investigation for use in early grades. Students sort, graph, analyze, write mathematical sentences and more. **See Pages 20-24.**

The Moon Shines Bright

Moonrise will become an unforgettable experience with a new AIMS investigation from Out of This World in which students will study the movement of the moon for five hours during full moon to predict the precise time it will rise the following four evenings. **See Pages 25-28.**

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ______________________

Address: ______________________
Street City
____
State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747

Kids...Kettler... Kinder-AIMS... and Kay!!!

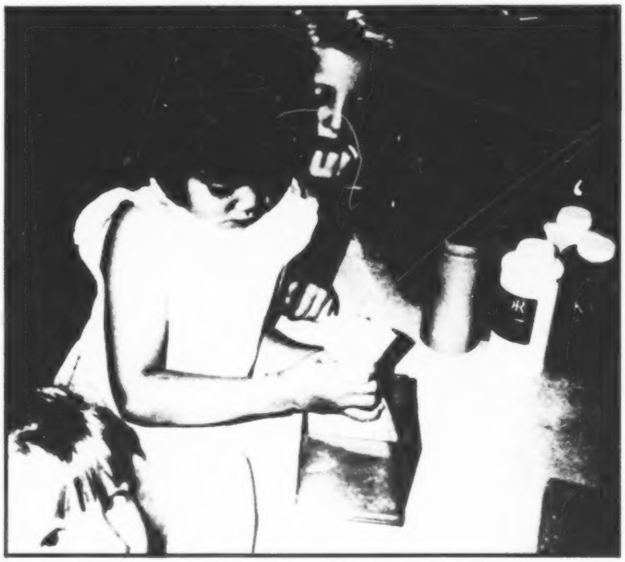
Project AIMS has arrived in Huntington Beach, and Kettler School will never be the same. The AIMS National Leadership Network takes pride in introducing Kay Fletcher, extended day kindergarten teacher, Huntington Beach City School District Mentor, and Kinder-AIMS Director. Kinder-AIMS is Kay's unique program developed as a part of her mentor project to give Kettler kindergarten students an integrated math and science curriculum in a hands-on lab situation.

In the past two years, Kay has received two state grants to further her work with Project AIMS. With the support of fellow teachers, Kettler parents, and Principal Clyde Glasser, Kay's grants in 1985 and 1986 have allowed her to place nearly $4,000 in equipment and materials into a tiny room adjacent to her classroom, now known as Kinder-Lab. Kettler kindergarten students happily investigate under the watchful eyes of teachers, aides, and volunteer parents.

Kinder-Lab materials include such consumables as M&Ms, and jelly beans and other manipulatives such as Teddy Bear counters, nuts and objects of brightly colored plastic. "We once thought of 18 different ways to sort nuts in the shells, from shape to texture to size, whatever," reports Kay. The Project AIMS materials are also available on a check-out basis for all K-5 teachers. "We've been able to buy things I never could have without the grant."

As a culminating grant activity, November 11 and 12 were declared Project AIMS Days at Kettler School. Judith Hillen, Project AIMS Director, and Sheldon Erickson, Fresno Unified School District Mentor Teacher and AIMS Network Leader, were honored guests at Kettler School. They spent Tuesday with all fourth and fifth graders constructing hot air balloons and followed that with a hands-on in-service for all K-5 Kettler teachers.

The following day was spent launching hot air balloons, and a Metric Olympics Fair and Airplane



Derby. The participating students and volunteer parent help learned more about measurement in that single day than they had ever been exposed to in the classroom. One of Kay's students put it into perspective this way, "It was the funnest day ever. Can we do it again tomorrow?" Present at that exciting event was Huntington Beach City School District Superintendent, Dr. Diana Peters, Board President, Pat Cohen, and many supportive parents and aides. They all agreed that sunshine, smiles, and science make a winning combination.

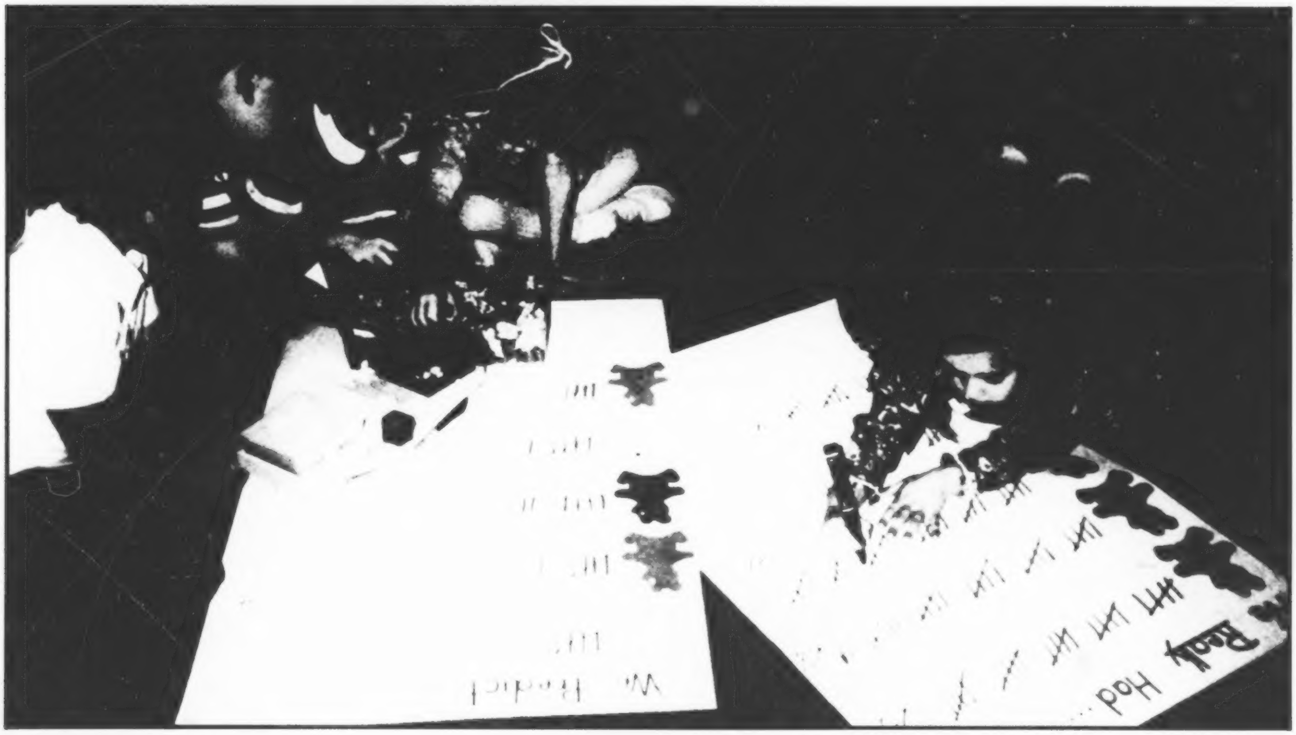
In her third year as a mentor, Kay's district focus is on critical and creative thinking in the area of K-2 math and science integration. Kay says of the hands-on activities in Project AIMS, "Basically what we're talking about is thinking, just plain old thinking. And if you can think in one subject area, it overlaps into the others."

Kay first became interested in Project AIMS when she attended a 10-day workshop at Fresno Pacific College during the summer of 1985. She recalls, "The idea was for me to come back and teach teachers to use hands-on, manipulative devices to make children excited about school. The purpose is to teach children with the concrete and wait on the abstract which will come when the concrete is there."

Kay, a Ventura native, is a graduate of the University of California, Santa Barbara with a B.A. in Dramatic Art and English. She has a Masters Degree in Special Education from California Lutheran College. Kay was the 1983 Teacher of the Year in Huntington Beach. She finds herself busy presenting District workshops, AIMS workshops, demonstration lessons, and with her consulting partner, has travelled around California presenting The Bear Necessities: K-2 Reading and Math Enrichment.

Kay is looking forward to her third summer on the Fresno Pacific College campus as a workshop leader in the AIMS Math/Science Workshops and as a mathematics instructor in the Festival of Mathematics, first grade strand.

Kay tells us "AIMS has really changed my life, and hopefully the lives of my students. First and foremost, they're learning to THINK, and that's what AIMS is all about. There is no stopping a thinking kindergartener." Kay will also be conducting a Project AIMS workshop in Ventura this summer. "It's so exciting to be going home to share AIMS with a district whose teachers have given me so much."



1st graders Dustin and Robin use Teddy Bear weights to weigh an orange without peeling: (Teddy Bear Math activity).

Campbell Union School District AIMS High

Art Ring

The Campbell Union School District began its implementation of Project AIMS in March, 1984, when Dr. Arthur Wiebe presented a one-day AIMS Workshop to the district's Science Curriculum Committee. The interest generated by this workshop was supported by the purchase of a set of the AIMS books for each school in the district. Committee members gained additional experiences through subsequent participation in AIMS investigations.

A group of teachers from the Committee became part of the staff for the district's first "Summer Science Institute" which was first held in August, 1984. This week-long summer teacher training program, funded through a Packard Foundation grant, provided many teachers with their first experience with the AIMS program. Their enthusiasm spilled over to their schools the next fall and interest mushroomed.

Following this initial effort, the use of AIMS has continued to gain momentum. Staff development courses featuring AIMS have been presented to K-3 and 4-6 grade teachers during the school year. These courses have been taught by district teachers for the last two years. All teachers attending gave these classes the highest possible rating in their evaluations. A typical comment was, "This class was fantastic! I'm really enthusiastic about trying these materials and ideas!"

Three of the teachers attended a week-long AIMS training workshop at Fresno Pacific College in Fresno, California to further their education and to receive additional investigations that were newly developed.

Each school in the district was provided with a set of 12 balances with masses and other typical AIMS equipment to support the implementation effort.

"Which jar has more things in it?" That's the question Aaron Anderson and Rebecca Carroll are pondering in their KN class at Hazelwood School.

Right

Amber, 1st grader in Luci Binz's class, classifies animals she's found in comic strips, as part of the "Cartoon Critters" activity in "Overhead & Underfoot" (p29).

Below

This "Eye Color" activity integrated math, science and art skills for Jackie Gliozzo's KN-1st grade students.

(Campbell, continued...)

The Summer Science Institutes continues to be held. Dr. Wiebe has been a workshop leader for the district's Science Curriculum Committee and a featured speaker at the Summer Science Institutes.

Because of the makeup of the district Science Committee, which includes representatives from each staff, a strong core of teachers who use AIMS has developed at each school. The district's Science Curriculum Committee has included AIMS in its newest K-6 Science Framework to supplement the content outline for each grade. Additional AIMS publications have been purchased for each school to support the science text adoption. One of the K-6 schools has developed a science laboratory so that all of its 4-6 grade students can experience hands-on investigations, taken largely from the AIMS series.

It appears that Project AIMS will continue to grow in the Campbell Union School District because it is perceived by many as an excellent vehicle for integrating mathematics, science, and language arts concepts on an experiential level. And, more importantly, AIMS addresses the critical need for providing students with real-life, problem-solving activities which stress the application of basic skills while underscoring the process skills of "learning how to learn" as well.

Peter checks the temperature with his 1st grade teacher, Luci Binz, to compare it to the morning reading. From "Temperatures Rising".

Art Ring was the Campbell District Science Co-ordinator until recently. Currently he teaches science education courses at San Jose State University and conducts AIMS Workshops as a member of the AIMS National Leadership Network.

Enriching Science... Content, Processes and Attitudes

Judith Hillen

For too many years, science in the elementary classroom has been last on the list of priorities and often first in the least favorite subject category by both teacher and student. Perhaps if we take a closer look at the three major components of a good science program, we will be better able to understand and change the complexion of science. Those three components are: scientific processes, scientific attitudes and science content.

Science teaching at the elementary level in the self-contained classroom has typically been textbook driven and reflected a "read the chapter and answer the question on page 19" mentality. **Science** is conspicuously absent from the activity; or perhaps present only by virtue of the fact that a science topic is being addressed. An excellent science lesson will include not only science **topics**, but also scientific **processes**, and scientific **attitudes**-and it is the combination of these components that gives strength and relevance to a study of science.

It is not difficult to identify science topics. Ask any adult or child what science is and the response most frequently will be: the study of biology, chemistry, physics, geology, etc. We **expect** a science lesson or program to focus on a science topic. If that is **all** that it does, we are falling far short of excellence in science education.

The study of science must necessarily be more than reading a science text like a novel, memorizing the names of the nine planets in the solar system in their respective order from the sun, or reciting Newton's Third Law of Motion. Reading, memorizing, and reciting information are trainable abilities that reflect short term goals (need to pass a text) and lower level thinking skills.

Edward de Bono, author of the CoRT Thinking Program, points out that "information is no substitute for thinking, and conversely, thinking is no substitute for information." More significantly, the accumulation of knowledge alone does not make one a scientist. Therefore, while knowledge and factual information are a necessary component of the study of science, the picture is incomplete.

Science includes the study of all of our universe; its composition and how it behaves. In order to complete or fulfill that study, we need to include not only the "what" (the information) but also the "how" and "why" (for understanding). The answers to those are best discovered by doing.

What does it mean to "do" as the scientist does? The scientist is confronted daily with using information to solve problems--using the known to understand the unknown. He uses **scientific methods** often referred to as process skills structured specifically to investigate and solve problems. Those process skills are listed here:

Science Process Skills (scientific methods)
1. Observe and Identify
2. Gather and Record Data
3. Hypothesize and Predict
4. Compare and Communicate
5. Experiment and Control Variables
6. Analyze and Evaluate (Test the Hypothesis)
7. Generalize and Apply

The science process skills focus on "doing" as we begin our science lessons in the real world. Students are naturally curious about the world around them but it is the job of the teacher to ask **creative** questions that cause youngsters to: (1) focus their attention on a given phenomenon or problem, (2) speculate or predict about the unknown, and (3) heighten their curiosity sufficiently to motivate them to stay involved in the problem solving process. For example: What happens when you place an egg in a glass of water? Materials (egg and water) and equipment (a glass) are readily available. Students of all ages will have a wide range of predictions-depending on their age and past experience. Typical responses may be of this nature: "It will get wet." "It will float." "It will sink." "Maybe it will hang in the middle and be suspended." "It will bounce." "It might break." or "The water will spill out."

It is absolutely crucial that the teacher encourages students to respond without fear of being "wrong". So much of our teaching has rewarded just one right answer! Consequently, many students (especially gifted ones) are afraid to guess because they are so competitive, they have to be "right". Some students may begin to ask questions which help give momentum to the experience such as: What kind of egg? Is it a fresh egg? How old is the egg? Is it raw or hard-boiled? The teacher can now ask counter questions that give rise to hypothesis making on the part of the students. What difference does it make? etc. One now has an atmosphere that is ripe for a hands-on experience.

The science processes begin with direct observation using as many of the five senses as possible. The egg is placed in the glass of water and students begin to describe and record what they observe happening. Questions will continue to surface as the students verbalize their wonder. Encourage that atmosphere of inquisitiveness. What might happen if we used hot or cold water? Does the egg behave differently in other liquids? Does the amount of water make a difference? If I added salt or sugar to the water, do the results change? These questions arise from the experience. The teacher becomes the stimulator of curiosity and inquisitiveness via the hands-on activity and does NOT

(see Enriching, Page 9)

174

AIMS Program Directors Slate Conference Presentations

Judith Hillen and Arthur Wiebe will be making presentations at five conferences during the January-March quarter.

Judith Hillen will present 2 sessions entitled "AIMS: Hands-On Math & Science" at the Greater San Diego Mathematics Conference, February 6-7. On February 27 she will speak on "Patterns in Problem Solving" at the Los Angeles County Teachers of Mathematics Conference. Judith will present three sessions entitled "AIMS-Hands On" at the 1987 CTA Good Teaching Conference, March 5-8.

Arthur Wiebe will conduct two AIMS orientation sessions at the ASCD Conference in Anaheim, California on January 30. Each will feature three hours of hands-on experiences in AIMS investigations. During the Greater San Diego Mathematics Conference, February 6-7, Arthur will make two presentations on Project AIMS. On February 27 he will speak on "Problem Solving ala Polya" at the Los Angeles County Teachers of Mathematics Conference at Loyola Marymount College in Los Angeles; and on "The Solar System: Problem Solving with AIMS".

Judith Hillen and Arthur Wiebe will make a joint presentation on Project AIMS at the National Science Teachers Association Conference in Washington, D.C. during the March 25-28 session. Also appearing in the national conference program are Helen Crossley and Sue Dixon, members of the AIMS National Leadership Network. Their presentation will deal with an AIMS investigation in the area of geology.

Enriching Continued...

need to know all the answers.

Each of the questions posed becomes a variable, which may affect the outcome of an activity. Each question also forms the basis for another hands-on experience where students may then ask the question, make a prediction or hypothesis, perform the experiment, record the data, and analyze and evaluate the results. The students are actively engaged in problem solving through the use of science process skills-an activity that is divergent and employs many of the higher level thinking skills for which we are **AIM**ing.

If one is to "do" as the scientist does, one must also exhibit the attitudes of a scientist. Of paramount importance in the science classroom is the role of the teacher and his/her effectiveness in fostering healthy, positive attitudes which may include: 1) an inquisitive spirit, 2) open-mindedness, 3) a desire for accuracy, 4) responsibile behavior, 5) a willingness to work cooperatively as well as independently, and 6) respect and appreciation for our world.

Any given lesson is subject to mediocrity without the enthusiastic and positive approach to learning modeled by the teacher. Textbook questions tend to be boring until a creative teacher comes along and makes science come alive by initiating creative questioning techniques and allowing students the freedom to experiment and wonder and perhaps even to fail...with dignity. The scientist "fails"ninety-nine per cent of the time but with perseverance re-forms the hypothesis and refines the technique each time until he finds the solution. If we indeed want youngsters to enjoy science, we need to provide an experience that is rich in content, process, and feeling.

China Continued...

affection publicly displayed in our own culture. However, holding hands, walking arm in arm, and warm affection is commonly seen, displayed and accepted between the same sex in China.

After the measuring and recording of the data took place, and the room quieted down after a very enthusiastic session, the students drew their own faces on the record sheet and we displayed them all around the classroom. Getting them to display their work was no easy task, either. Chinese classrooms are usually quite stark free of visual aids, pictures, or the like. Occasionally, the answers to quizzes or exams might be posted but that's about it.

From "How Do You Measure Up" to "Dem Bones" and other investigations, I used AIMS to build and develop strong vocabulary and communicative skills with these students who gradually began to adapt to this new method of learning and discover that classroom participation could be fun and exciting.

Our culminating lesson with "Dem Bones" was to outline each other on larger paper, paste the drawings of bones in the proper place, and cut out these life-size skeleton figures. We displayed all of them in a huge auditorium and they served as the decorations for a Halloween party we had at the end of October to introduce another American custom to China.

As I walked around the large area looking at all the skeleton figures and noticed all the differences, I was delighted and surprised to see that one of the students had arranged the bony skeleton hand of one of the figures so that it appeared to be holding hands with the skeleton next to it. The subtle humor that had been intended brought a feeling of amusement to all that noticed.

Teddy Bear Project AIMS for Success

by Lana Fricke with thanks to Gwen Whitaker

Adding Language Arts to an already integrated mathematics and science program is easy when Teddy Bears are the subject matter. Because Teddy Bears are so popular and accessible, most students are familiar with and own at least one of them. So, to brighten up our first month of school, we held Teddy Bear Week.

To begin, as a homework project, each student interviewed their Teddy Bears, finding out such vital statistics as name, where they came from, their favorite sports, food, and what the bears like to do best, especially while their owners were at school.

Next, in class, everyone wrote invitations to their bears, asking them to come to school for a tea party. We decorated the room with Teddy Bear art, and throughout the week I read different bear stories to the class, including **Corduroy, Winnie the Pooh, and Ira Sleeps Over.** We also clustered Teddy Bear words, and made a Venn diagram of "when I was little, I slept with...a Teddy Bear, another stuffed animal, a blanket."

As the bears trickled in we were able to begin the AIMS activities weighing and measuring, etc. Several children brought in more than one bear, so we were able to create an "adopt a bear" center for those who had no bears. I filled a large jar with gummy bears and the children estimated how many gummy bears there were. Afterwards, we graphed the gummy bears according to color.

On the day of the tea party, which was video-taped, we took turns introducing our bears to the class, and giving each bear an award: the most cuddly, loving, biggest, etc. After feasting on crackers, honey, marmalade and apple juice, we made a second Venn diagram of "My Teddy Bear likes to eat...honey, marmalade, porridge."

As further follow up, the class shared their ideas of why Teddy Bears make the best friends and wrote their Teddy Bear's life story. Later, we did a reader's theater from **Ira Sleeps Over**, by Bernard Waber.

This project was very enthusiastically received and enjoyed by the entire class and set the tone for the integration of other Language Arts activities with AIMS investigations.

Lana Frinke is a 3rd Grade Teacher in Justin Elementary School in Simi Valley Unified School District, Simi Valley, California.

"Out Of This World" Publication Scheduled

The AIMS Education Foundation has scheduled the publication of a new volume in the AIMS series for February 25. This is the first of two books dealing with the solar system and astronomy.

The content of "Out of This World, Book A" focuses on the planets in our solar system and is designed for students in grades 4-9.

The writers have faced the challenge of an imaginative approach to the study of the solar system with success. While the book contains some traditional activities, it breaks considerable new ground in the form of the activities. A number of fact sheets are included, in addition to the investigations, to augment the content. Completion of the investigations in this publication will give the students a solid background in understanding our solar system.

DESCRIPTION OF BOOK A CONTENT

There follows a brief description of the investigations in **Out Of This World.** Titles of the investigations are in italics.

Earth and Her Neighbors are fact sheets that provide a brief introduction to each of the planets including the symbols used for each.

Can You Planet gives information about the diameters, moons, and length of day on each planet which students use for making a Venn Diagram and graphing.

Planetary Facts consists of several fact sheets, additional planetary facts, and making more Venn Diagrams using these facts.

Spacing Out the System defines an astronomical unit, provides several interesting fact sheets, and has students determine the relative distance of the planets in order to construct a model solar system.

Size It Up has students determine the relative sizes of the planets and then make models out of clay.

In *Planetary Scavenger Hunt* students use a marble to represent earth and then find balls and other spherical objects to approximate the relative sizes of the other planets; or use a basketball as Saturn and find objects for the other planets. Extensive use of ratio and proportion is involved.

Extra Terrestrial Excursions asks students to compute travel time to the moon and the planets to determine their age upon arrival.

In *Extra Terrestrial Excursion: Special Delivery* students imagine they work for a Solar System Delivery Service and determine the time necessary to make certain deliveries and return to earth.

How Long Does It Take to Say Hello? asks students to compute the time it takes for a message to reach the moon and the planets.

Space Talk is a simulation activity in which earth-planet teams communicate, using the time required for a radio message to travel to and from each of the planets.

Weight in Space helps students compute their weight on the moon and the other planets.

Your Weight in Space is a computer program written in BASIC which will automatically provide the translation from earth to any of the planets.

In *Galactic Games* students compete in various athletic events and then translate the results as they would occur on the moon, Mercury, Mars, Venue, Uranus, Jupiter, Saturn, and Pluto.

Planet Trivia is a game through which students will become familiar with many interesting facts about the solar system.

Phone Home is a simulation of repairing a space ship by voice instructions. Earth-space ship teams exchange information as they attempt to correct a malfunction in the instrument panel. To determine whether the malfunction has been corrected, teams compare the appearance of their instrument panels.

Space Capsule asks student groups to determine what elements or objects in various categories should be selected for inclusion in a space capsule to be sent to another planet outside our solar system where intelligent life is probable.

Around the Planets in How Many Days has students compute how long it would take to travel around a planet and at what cost in fuel using a land rover. It provides another comparison of their size with the earth.

Round and Round has students experiment with elliptical shapes to discover the shapes of planet orbits.

The Moon Shines Bright is an activity in which students will chart the position of the Moon every 30 minutes for five hours and determine the number of degrees of movement. From that they will predict when the Moon will rise on each of the four following evenings. Finally, they will check their predictions against the actual time it rises.

PROJECTED CONTENT OF "OUT OF THIS WORLD, BOOK B"

Book B will concentrate on studies of the Sun, Moon, and stars. It is scheduled for publication in the Fall of 1987.

The projected content will include the following investigations, many of which are currently being field-tested.

Going in Circles gives students the opportunity to investigate the effect of centrifugal and centripetal forces and the balance between the two in a hands-on activity to illustrate how the planet's motion and course and the sun's gravity balance each other.

In *Stranded on the Moon* students examine their supplies and list them in the order of their importance. The result is compared with the NASA ranking.

(see Out of This World, Page 18)

V. ROCKCASTLE J. ABRUSCATO D. ALBERTI G. YEE D. SCHATZ

Fresno Pacific Math-Science Project announces the

1987 SCIENCE FESTIVAL

July 20-31, 1987

Theme: Processes and Content in Science

4 SEMESTER UNITS OF CREDIT

Designed especially for:

- ★ **Innovative Elementary and Middle School Teachers**
- ★ **Science Supervisors**
- ★ **Science Resource Teachers**
- ★ **Mentor Teachers**
- ★ **Curriculum Coordinators**

Major Science Festival Features

- VERNE ROCKCASTLE will draw upon a lifetime of experience in teaching science, conducting staff development programs in science education, and authoring elementary and middle school science texts to share meaningful and practical activities that thousands of teachers have found helpful. He has the special gift of being able to clarify some of the more complex science concepts. He comes from Cornell University.
- DEL ALBERTI, a much sought-after science workshop instructor, makes a unique contribution from the perspective of a curriculum oriented school administrator. He is widely recognized for his leadership in curriculum innovation and implementation and will share the details of a carefully crafted program of implementation of a hands-on science program used in his own district.
- DENNIS SCHATZ will make a distinctive contribution in the area of astronomy. He is highly regarded for the clarity of his presentations. Dennis is Associate Director of the Pacific Science Center in Seattle, Washington. He annually heads the Astronomical Society of the Pacific's teacher workshop and offers astronomy education workshops across the United States.
- A NEW FEATURE of the 1987 Science Festival will be the daily hands-on laboratory sessions. Two options will be available: a biology laboratory and a physical and earth science laboratory. Participants may make daily choices between the two.
- TED OSTRANDER will direct the physical and earth science laboratory. This will feature a broad range of activities including the construction of model rockets, simple electrical circuits, kites, wire geo-pane structures, kaleidoscopes, solar system measuring devices, posters, instructional materials and various devices suggested by faculty. Teachers will also be able to construct and calibrate their own measuring instruments. New AIMS earth and physical science activities will be shared.
- JOSEPH ABRUSCATO brings a strong interdisciplinary emphasis for integrating science with mathematics, language arts, and social studies. Participants in the 1986 Science Festival gave very high marks to this contribution and have incorporated this approach into their teaching. This integration is exemplified in the context of hands-on activities throughout. He is the author of a current elementary science program. He comes from the University of Vermont.
- GILBERT YEE draws upon his years of experience as an exemplary classroom teacher to present stimulating activities in science using a hands-on approach. He has won numerous honors as a classroom teacher and participants soon recognize why as he leads them through hands-on activities. He will also share information on the development of a science resource center and its operation to heighten student interest in science.
- KIM SUTTON and DAVE YOUNGS, members of the AIMS National Leadership Network, will teach the AIMS strands. Activities will include many of the new investigations currently being field-tested in preparation for publication. Both are current classroom teachers and are much appreciated as workshop presenters. Kim was featured in the August AIMS Newsletter. Dave was a member of the original NSF funded writing project. He is returning from a two-year teaching assignment in Africa where he also presented AIMS Workshops.
- MIKE WOODS will direct the biology laboratory. He is the author of a forthcoming AIMS book of investigations utilizing a low-cost microscope and will share these activities. Another special feature of this lab will be the availability of state-of-the-art equipment for making video-tapes using powerful microscopes and macroscopes. It is envisioned that teams of Festival participants will produce video-tapes showing subjects beyond the range of more inexpensive scopes. These will be duplicated and made available to all participants at cost.
- ARTHUR WIEBE, program director of Project AIMS, will serve as program director of the Science Festival and make several general session presentations on AIMS philosophy and the status of current AIMS programs such as the AIMS National Leadership Training Program, projected new writing projects, etc.

K. SUTTON D. YOUNGS M. WOODS T. OSTRANDER A. WIEBE

DAILY SCHEDULE

Participants will be divided into six groups, with attention to grade level assignments, for the purpose of scheduling.

	Group	First Period	Second Period	Third Period	Fourth Period
FIRST WEEK	A	Abruscato	Yee	Biology Lab	Sutton
	B	Sutton	Abruscato	Yee	Biology Lab
	C	Biology Lab	Sutton	Abruscato	Yee
	D	Rockcastle	Schatz	Phys. Sci. Lab	Youngs
	E	Youngs	Rockcastle	Schatz	Phys. Sci. Lab
	F	Phys Sci. Lab	Youngs	Rockcastle	Schatz
	Group	**First Period**	**Second Period**	**Third Period**	**Fourth Period**
SECOND WEEK	A	Rockcastle	Alberti	Phys. Sci. Lab	Youngs
	B	Youngs	Rockcastle	Alberti	Phys. Sci. Lab
	C	Phys. Sci. Lab	Youngs	Rockcastle	Alberti
	D	Abruscato	Yee	Biology Lab	Sutton
	E	Sutton	Abruscato	Yee	Biology Lab
	F	Biology Lab	Sutton	Abruscato	Yee

FACULTY

The Second Annual Science Festival offers an unusually rich program of instruction, hands-on experiences, laboratory opportunities, science software evaluation options, and exposure to an abundance of curriculum resources.

A faculty consisting of some of the nation's leading science educators will serve in this Festival. As noted on the introductory page, the faculty provides a broad cross-section of the science education spectrum. Authors, experienced workshop leaders, outstanding classroom teachers, and staff development personnel are included.

All topics will be coordinated among the members of the faculty to minimize duplication and broaden the scope of the content.

FOCUS

The entire program is built on the content of the California Science Framework Addendum and the Model Curriculum Standards. Instruction will consist of hands-on experiences with appropriate background information. Major topics in biological, physical, and earth science will be covered. Participants will receive an abundance of materials in the form of handouts, two Project AIMS books, resources prepared during the laboratory periods, and correlations of AIMS activities to the Framework. A variety of science education implementation programs will be presented.

PRE-REGISTRATION

Enrollment in the Science Festival is limited to 45 participants in each of the six strands, a total enrollment of 260. It is important that teachers planning to attend submit the pre-registration information as early as possible to be assured acceptance.

SCHOOL DISTRICT SUPPORT

School districts will find that the funding of teachers to participate in the Science Festival is a cost-effective investment. In its first year the Festival gained national recognition for its innovative and rich program. Participants gave the instructional program the highest possible rating in their evaluations. The benefits from the first Science Festival are now being experienced in scores of schools and school districts, many of whom funded the participation of their teachers. The Science Festival provides an opportunity to receive maximum benefit from the utilization of PL 98-377 funds.

FESTIVAL FEES

The basic fee for the Science Festival is $340. Participants taking the Festival for 4 semester units of in-service credit will pay an additional $40 or a total of $380. Those taking the Festival for 4 semester units of graduate credit will pay an additional $80 or a total of $420. On campus meals and lodging are available at reasonable rates as outlined in the general information section of this brochure.

1987 SCIENCE FESTIVAL PRE-REGISTRATION

ALL information requested below must be supplied before this pre-registration can be processed. Full registration and housing information will be mailed upon such acceptance.

Name ______________________ Soc. Sec. No. ______________

Street ______________________ City ______________

State ____________ Zip ____________ Home Phone (_____) ______________

School Address ______________________

School Phone (_____) ______________________ I plan to register for: ☐ Graduate Credit

Do you plan to live on campus? ☐ In-Service Credit

☐ Yes ☐ No ☐ No Credit

Mail to: *Dr. Arthur Wiebe, Science Festival, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702.*

For Office Use Only

Date Received: ______________ Processed by: ______________________

Copy to: ☐ Registrar ☐ In-Service ☐ Business Office ☐ Housing

TEDDY BEARS PLAYING IN THE DEN

I. Topic Area

The use of random samples to make predictions about a population.

II. Introductory Statement

Students will investigate random samples to determine how they can be used to make predictions about the nature of a population. In both science and mathematics, generalizations are frequently drawn from random samples.

III. Math Skills

a. Random sampling
b. Classifying and counting
c. Entering information into a table
d. Ordering
e. Writing mathematical sentences
f. Adding
g. Constructing a circle graph

Science Processes

a. Classifying
b. Organizing data
c. Drawing conclusions
d. Generalizing
e. Hypothesizing
f. Predicting
g. Comparing

IV. Materials

24 Teddy Bears or other objects divisible into four categories for each group

A container such as a box for each group.

V. Key Question

Can we predict how many Teddy Bears there are of each color from drawing random samples?

VI. Background Information

Random samples are used extensively in our society to form the basis for drawing conclusions. Quality control in many industries consists of taking random samples and subjecting them to texts. **Consumers Report,** for example, continually tests random samples to determine the quality of products. New drugs are tested in a similar manner. Political pollsters use random sampling as the basis for their projections.

A random sample is one in which no bias occurs in the selection of the sample. The entire group is known as the population. So, we make a prediction about the population from a random sample or samples.

VII. Management Suggestions

Organize the students into cooperative learning groups. Encourage the groups to discuss their conclusions and arrive at their best group predictions.

VIII. Procedure

1. Organize students into cooperative learing groups.
2. Supply each group with 24 Teddy Bears of assorted colors with one color predominant and another deficient. Also, provide each group with a container in which to hide the Teddy Bears.
3. Students will thoroughly mix the Teddy Bears without looking into the container and then draw out six for each sample at random. Be sure to emphasize the nature and requirement of a random selection.
4. As each sample is drawn, students will classify them, count each sub-group and enter the information in the table. The sample will then be returned to the container and thoroughly mixed with the rest of the population.
5. After the total of each color is determined for the four samples, the group should discuss what their prediction about the 24 Teddy Bears should be and enter that into the table.
6. The distribution should then be graphed in the "prediction" rim of the circle graph.
7. Students will next empty the entire population out of the box and classify the Teddy Bears.
8. Students will enter the information in the table and compare it with their predictions.
9. The Teddy Bears will then be placed into the indicated regions in the outer rim of the circle graph to form a three-dimensional circle graph.
10. The students will visually compare their prediction and the population using the graph.
11. Students will complete the final page, writing statements and mathematical sentences.

IX. Discussion

1. What is a random sample? A population?
2. How accurately could we predict from the random samples?
3. Why is it important to thoroughly mix the Teddy Bears before a sample is drawn?
4. Why should the drawing be made without looking?
5. Where are random samples used?

X. Extensions

1. Try other sampling configurations using samples of other sizes with populations of other sizes.
2. Have students develop a sampling activity such as taking a poll from a sample and predicting it onto a population.
3. If the school has a hot lunch program, have students use the information as to the number in the classroom participating each day of the week to predict the number from the school participating.
4. Have the students gather newspaper articles that are based on predicting on the basis of a sample.

Name

TEDDY BEARS

Playing in the Den

1. 24 Teddy Bears are playing a game in their den. They are hidden from view. Every little while, 6 are sent out while the rest lay their plans in secret. The 6 who come out are selected at random. Some have been sent out before, some are sent out for the first time.

Your task is to make the best guess as to how many Teddy Bears there are of each color.

My Guess

1. I think there will be more______Teddy Bears than any other color.
2. I think there will be fewer______Teddy Bears than any other color.

2. Pick out 6 Teddy Bears for each sample without looking into the den (box). After the number of Teddy Bears of each color in the sample has been recorded, put them back into the den, mix them up thoroughly, and pick 6 more until 4 samples have been checked.

	Blue	Red	Green	Yellow
First Sample				
Second Sample				
Third Sample				
Fourth Sample				
Total in all Samples				

3. From this information, predict how many there actually are of each color. Graph this on the circle graph. Then bring all the Teddy Bears out of the den and count the number of each color. Compare the actual with your prediction.

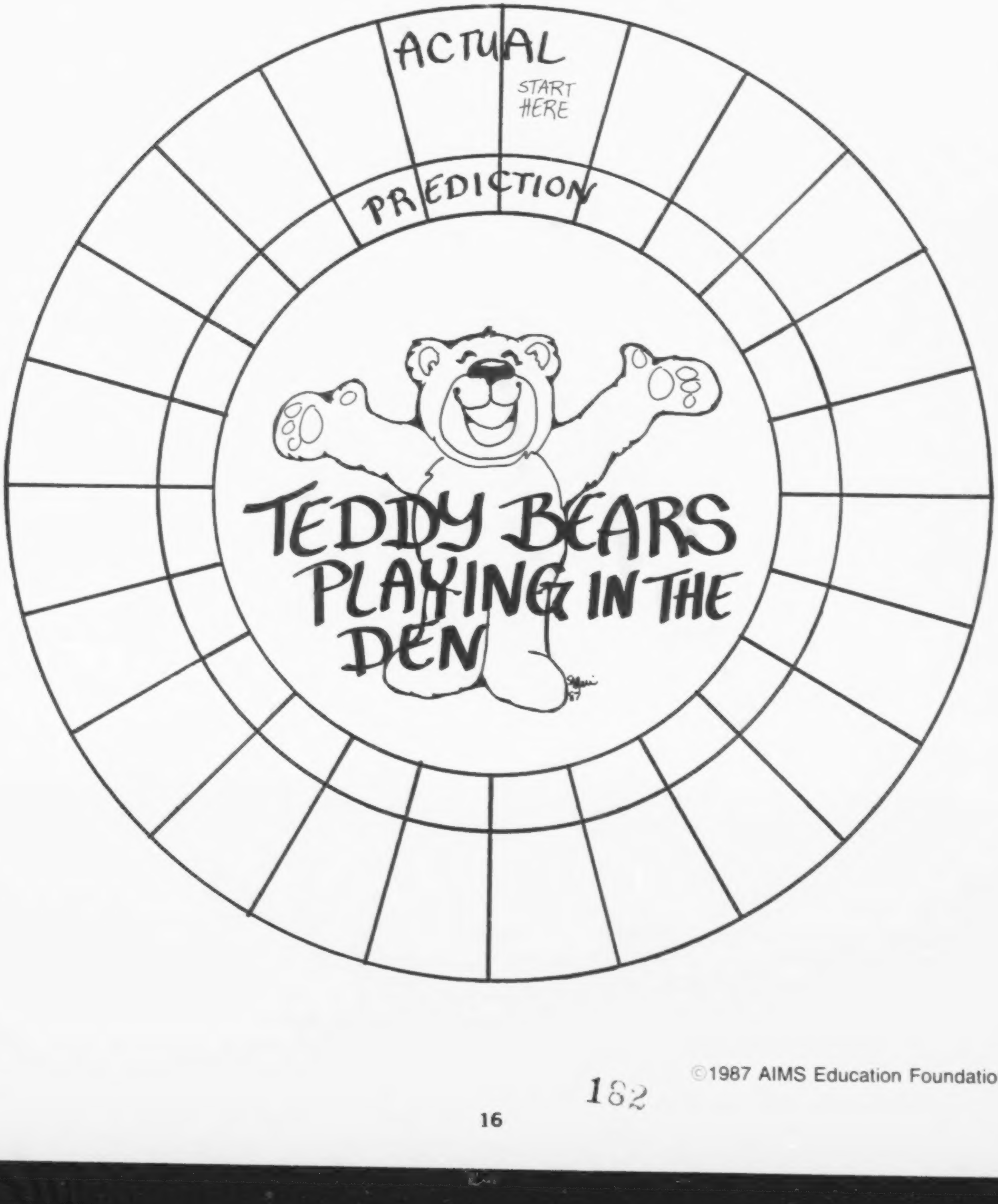
	Blue	Red	Green	Yellow
My Prediction				
The Actual Number				

4. The colors of the Teddy Bears arranged from most to least is:

________ , ________ , ________ , ________
most, least

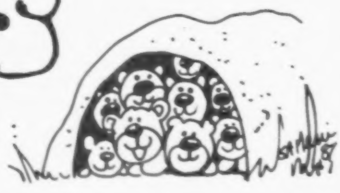
Graph your predictions for the number of Teddy Bears of each color. Use the order of blue, red, green, and yellow beginning at "12 o'clock". Use the same colors as the Teddy Bears.

Next, place the Teddy Bears on the outside rim of your circle graph to form a real "Teddy Bear Graph". Use the same color order of blue, red, green, and yellow, also beginning at "12 o'clock."



______________ Name

TEDDY BEARS
Playing in the Den



1. Compare your prediction with the actual result. ________

____

2. Complete 4 different sentences from your investigation, each in two ways. Use the names of colors in the first, and numbers in the second.

a. There are more ______ Teddy Bears than ______ ones.
______ > ______

b. There are more ______ Teddy Bears than ______ ones.
______ > ______

c. There are fewer ______ Teddy Bears than _____ ones.
______ < ______

d. There are fewer ______ Teddy Bears than _____ ones.
______ < ______

3. Which sample is most like the actual result? ____________

____

4. Are 4 samples better than just one sample? Explain: ____

____

____

5. Complete these sentences from the result of the fullset of 24 bears.

a. ____ + ____ = ____
red blue

c. ____ + ____ = ____
green yellow

b. ____ + ____ = ____
green red

d. ____ + ____ = ____
yellow blue

THE TEDDY BEARS GO SLEDDING

I. **Topic Area**

Patterns, arrangements (permutations), and problem solving.

II. **Introductory Statement**

Students will explore arrangements or permutation involving 2, 3, and 4 objects to create a pattern for predicting a general result.

III. **Math Skills**

a. Forming arrangements
b. Studying patterns
c. Generalizing

Science Processes

a. Organizing data
b. Drawing conclusions
c. Hypothesizing
d. Predicting

IV. **Materials**

4 Teddy Bears of different colors

A sheet of paper for listing all of the possible arrangements.

V. **Key Question**

In how many ways could 2, 3, or 4 people arrange themselves on a sled?

VI. **Background Information**

The number of arrangements or permutations with **n** objects is n!

For example, the number of arrangements of 2 objects is 2! or 2x1=2.

The number of arrangements of 3 objects is 3! or 3x2x1=6.

The number of arrangements of 4 objects is 4! or 4x3x2x1=24.

Obviously, the number increases rapidly since 5! =120 and 6! =720, etc.

VII. **Management Suggestions**

Students may work individually or in cooperative learning groups. They should share their results by comparing individual arrangements. Students could be encouraged to find a systematic way of making sure they have all of the arrangements.

VIII. **Procedure**

1. Have students find all possible arrangements for two objects, in this case two Teddy Bears on a sled, and record it in the table.
2. Next, have students find all possible arrangements of three Teddy Bears. Since there are six cases this will be a challenge for some students. Enter the result in the table.
3. Have students find the arrangements possible with four objects. This will challenge all of the students. If some students have found a systematic way of doing this, have them share this with the class.
4. Introduce students to the notion of factorial notation. Lead them to discover the general result.

IX. **Discussion**

1. What do expressions such as 7! mean?
2. In how many ways could 8 people arrange themselves in a row for a picture?

Out of this World Continued...

In *Space Capsule II* students make their selections according to more advanced categories than those used in a Russian survey. They then contrast their selections with those made by Russian students.

In *How Wide, How Far* students will build a simple, inexpensive instrument for determining the size of objects on earth and their distance for the viewer as preparation for *How Wide the Moon*. In the latter, students will actually measure the diameter of the moon using their instruments.

Moonrise, Moonset has students graph the changing times of moonrise and moonset and the length of time the moon shines.

The Moon's Footprints provides the information by which students calculate the length and time of the moon's orbit.

Tracking the Moon involves charting the location of the moon at sunset from new moon to full moon and at sunrise from full moon to new moon through actual daily readings.

Where Does the Moon Rise and Set? Students study the location of moonrise and moonset with respect to an imaginary east-west line to learn how that location changes during a longer period of time.

Apollo Mission to the Moon is a summary of the Apollo Mission and contains the names of astronauts, the names of the command module and lunar module, the location of landing, and the major exploration for each of the missions. Extensive reading references of this exciting story are cited for additional readings.

The Apollo Spacecraft is a fact sheet describing the spacecraft used for these missions.

Apollo Landing Sites has students graph the location of the landing sites for each of the missions while becoming familiar with the geography of the moon.

Your Apollo Mission to the Moon asks students to plan and staff an Apollo mission of their own design indicating the purpose of the mission, landing site, names of spaceship components, astronauts, etc. A full report from blastoff to splashdown is required.

Know Your Moon is a fact sheet giving interesting facts about the moon, some discovered during the Apollo missions.

Wide, Wide as the Sun invites students to compute the width of the sun by two methods: a pin-hole camera and a simple lens system.

In *Sunrise, Sunset* students gather extensive data about the sun by observation. They complete clock

(continued on Page 32)

Name

The TEDDY BEARS Go Sledding

1. Two Teddy Bears are trying to decide how they should arrange themselves on a sled. One has a yellow suit and the other a red one. Help them find all the possible ways.

Front Seat	Back Seat
yellow	
red	

2. A third Teddy Bear dressed in a blue suit joins them. Now, in how many ways can they arrange themselves on a sled?

Front	Center	Back
yellow		
yellow		
red		
red		
blue		
blue		

3. Later, a fourth Teddy Bear dressed in a green suit joins the first three. In how many ways can 4 Teddy Bears arrange themselves on the sled? Design your own chart below.

4. Place the gathered information into this table. Look for a pattern.

Number of Teddy Bears	Number of Arrangements
Two	
Three	
Four	

5. CHALLENGE! How many ways would 5 Teddy Bears arrange themselves on the sled?

M&M MATH

I. **Topic Area**
Process skills and cooperative learning

II. **Introductory Statement**
In this activity the students will estimate the number of M&M's, and complete the activities of addition and subtraction. Students will also be asked to use letters to represent the colors of M&M's and perform operations of addition and subtraction or state relationships.

III. **Math Skills**
- a. Counting
- b. Comparing
- c. Relationships
- d. Addition
- e. Subtraction
- f. Grouping Information
- g. Graphing

Science Processes
- a. Gathering Data
- b. Recording Data
- c. Estimating
- d. Sorting
- e. Classifying
- f. Interpreting Data
- g. Predicting

IV. **Materials** (per group)
One bag of M&M's plain candies per group of three students (a Cooperative Learning trio.)
Four Student Worksheets
Colored pencils, markers, or crayons

V. **Key Questions**
How many M&M's are there in one bag?
The color with the greatest number of M&M's is ________ .
The color with the fewest number of M&M's is ________ .

VI. **Management Suggestions**
1. Have the class work in grougs of 3 or 4 pupils.
2. Assign a task to each child in each group:
   - a. A RECORDER to write the number of each color of M&M's and to record answers.
   - b. A SORTER to separate the M&M's into colors.
   - c. A GRAPHER to prepare a picture or bar graph of the number of M&M's in the group's bag.
3. You may want each child to complete the questions 1 through 10 or you may want each trio to turn in one completed paper for their Cooperative Group. If you do this remember that each child's name should be on the completed worksheets and be able to tell or report just what happened in each part of the activity.
4. This activity should take approximately 40 minutes. It is designed to take one group the amount of time for one group period. You may want to extend this activity to another period of time with the whole class preparing whole class records, graphs, and prediciting the number of M&M's that each group has.

VII. **Procedure**
1. Assign the students to cooperative learning groups of 3 or 4 pupils. You may do this by having the children "count off" by tens. If you have 30 children in your class-all of the ones form one group; all the twos form another group; all the threes form a group etc., until all of the children are in a group.
2. Have children move to their groups. Explain that each group will be working together as a team and that they will complete their activity together. At this point, it would be good for them to receive the four worksheets. Pass out one set of four worksheets for the group. Explain that each person will have a very important job to perform for the group.
   - a. The SORTER will open the bag of M&M's (remember that you have not passed out the bags of M&M's yet) and sort them by colors. Have SORTER hold up the worksheet that has the six circles with colors printed in the centers-red, orange, green, yellow, light brown, and dark brown-so that everyone knows what sheet is being used and so that each SORTER knows his/her job.
   - b. The RECORDER is to work with the two worksheets with the numerals 1-11 on them. Have the RECORDER show his two worksheets. He/She will record the number of M&M's by color and will be assisted by the others in the group; especially the SORTER. All three members of the group are to confirm that they know how many of each color of M&M's there are in their bag.
   - c. The GRAPHER is to work with the single worksheet that shows spaces for each color in five columns; have each GRAPHER show this worksheet. GRAPHERS can prepare bar graphs by extending each column with additional paper glued to the top of the worksheet. The GRAPHER can also prepare a chart showing the number of M&M's for each color by drawing small circles in each column.
3. Next, pass out the M&M bags (one bag to each trio). Have each student begin his/her task in the activity. If each child is doing individual worksheets be certain that records of all the information is recorded on each of the worksheets.
4. Be certain that the students know what each of the symbols mean on the worksheets:

   G represents green colored M&M's
   R represents red colored M&M's
   RB represnets light brown colored M&M's
   O represents orange colored M&M's
   Y represents yellow colored M&M's
   DB represents dark brown colored M&M's

   $>$ means greater than
   $<$ means less than
   = means equal to

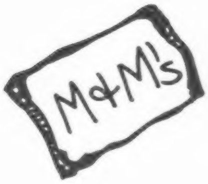
   LB+DB= means the number of light brown M&M's plus the number of dark brown M&M's equals________?
5. Remember that each student is part of the learning group and that the M&M's can be used to actually count and solve the problems. Allow the students to manipulate the M&M's and check each others answers.
6. In doing problem number 8, please make certain that each student has 15 M&M's and that the left overs are set aside or placed in a container until the activity is completed. This part of the activity is an excellent place for cooperation to take place and confirmation of right answers to happen. Encourage each child in the group to do his/her part. This is a good division readiness activity to move into.
7. Complete the graph and post the results from each group.

What the Students Will Do

VIII.
1. Students will predict how many M&M's are in each bag.
2. Each student will perform his/her task with the cooperative group activity.
3. The students will classify, group, and record the data.
4. Students will perform the operations of addition and subtraction.
5. Students will prepare a graph telling how many M&M's are in the bag to check their prediction.
6. Students will write a short report about their bag of M&M's.

(Continued on Page 25)

Name ____________________



M&M's

red

orange

green

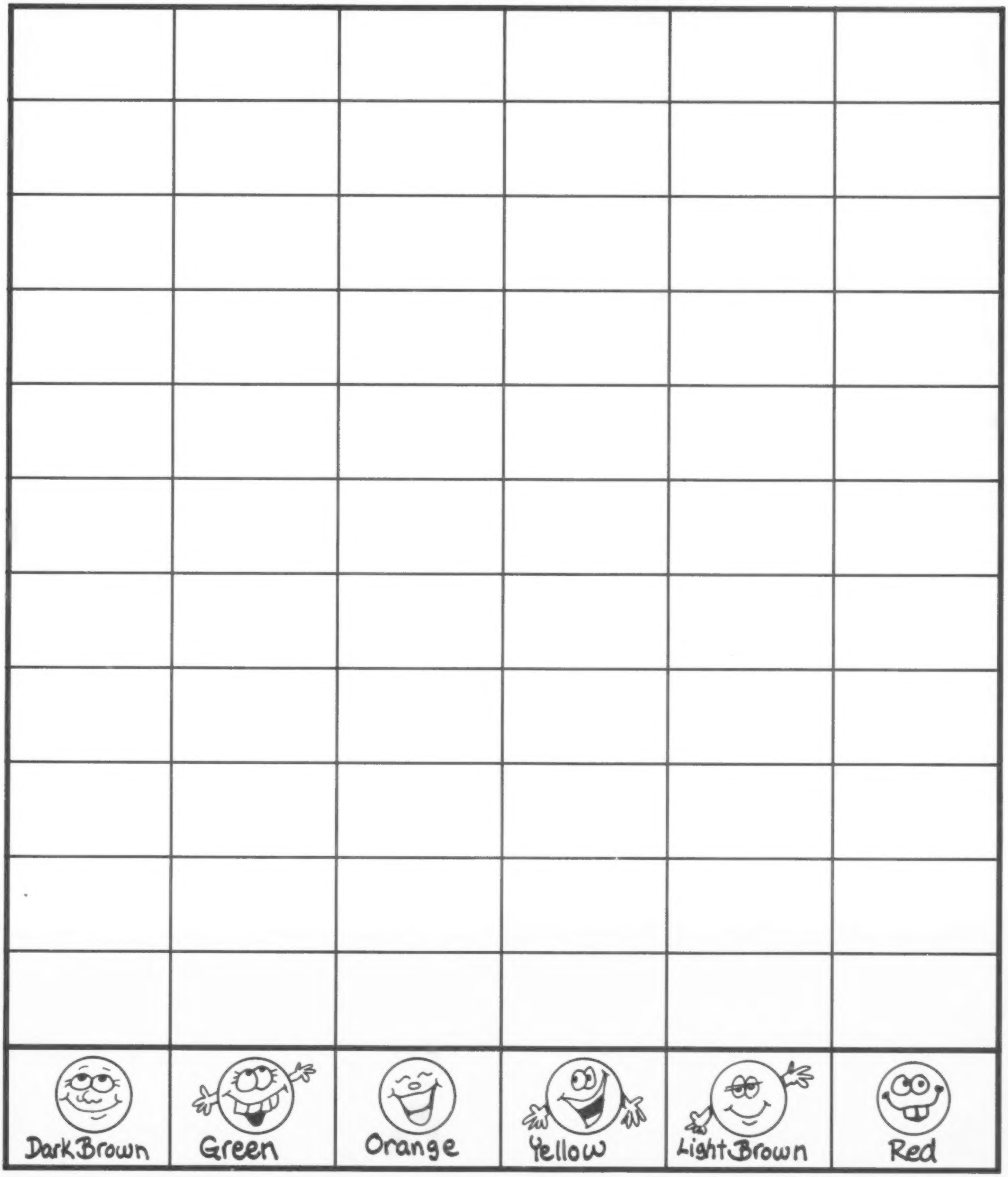
Sort your M&M's by color.

light brown

dark brown

yellow

M&M Math



____
Name

M&M Math

1. Do not open your bag yet.
Guess how many M&M's are in the bag? ____________

2. Open your bag, count the M&M's.
How many M&M's are in the bag? ____________

3. How far off was your guess? ____________

4. Put your M&M's into sets by color.

○ green = G ○ red = R ○ light brown = LB
○ orange = O ○ yellow = Y ○ dark brown = DB

5. Write the number of M&M's you have in each set.

set G = ________ set R = ________ set LB = ________
set O = ________ set Y = ________ set DB = ________

6. Using > or < or =, show the relationship between these sets.

G ____ R
O ____ G
G ____ LB
Y ____ DB
DB ____ LB
Y ____ R
Y ____ LB
G ____ Y
G ____ DB

7. Do these problems:

LB + DB = ________ O + G = ________ O + LB = ________
R + O = ________ R + Y = ________ G + LB = ________
R + G = ________ Y + LB = ________

____________________ Name

M&M Math (continued)

8. Put 15 M&M's in a pile in front of you. Use them to do these problems.

How many piles of four can you make? ________
How many are left over? ________

How many piles of seven can you make? ________
How many are left over? ________

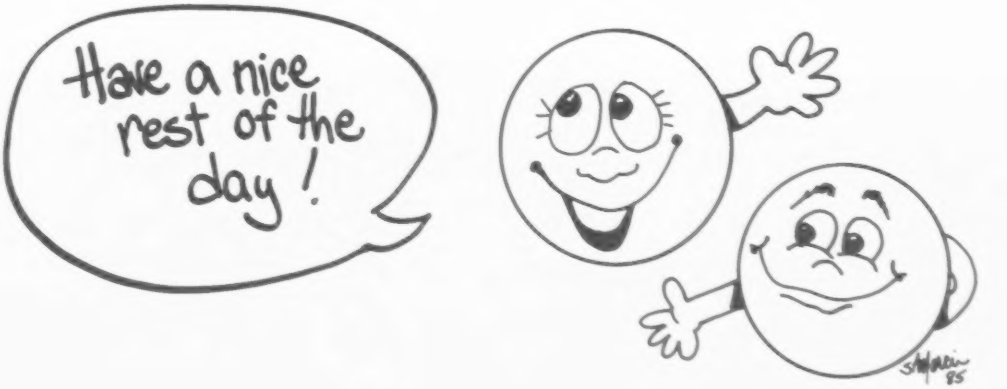
How many piles of five can you make? ________
How many are left over? ________

How many piles of two can you make? ________
How many are left over? ________

9. Put two M&M's in your mouth.
How many are left? ________

10. Eat four more.
How many M&M's do you have left now? ________

11. Do what you wish with the rest of your M&M's. Eat them now, save them, take them home OR hold them in your hand and see if they melt!!!!!!


Have a nice rest of the day!
s.Hyman 85

THE MOON SHINES BRIGHT

I. Topic Area

The apparent movement of the moon

II. Introductory Statement

Students will chart the apparent movement of the moon over a five-hour period and use the information to predict when the moon will rise the following evening.

III.

Math Skills	Science Processes
a. Measuring angles	a. Observing
b. Recording data in a table	b. Measuring
c. Graphing	c. Organizing data
d. Computing an average	d. Comparing
e. Applying information	e. Inferring
	f. Applying

IV. Materials

A Clear night at approximately full moon
Student worksheets

V. Key Question

Can we predict when the moon will rise tomorrow evening?

VI. Background Information

Each night the moon will appear a little further to the east amongst the stars as the moon pursues its path around the earth. It is this latter movement which causes it to rise approximately fifty minutes later each night. By measuring the progress of the moon over a five hour period, students should be able to arrive at this approximation and from that predict the rising time of the moon with accuracy. The movement per half-hour is easily detected since the movement per hour is about 14-15°.

VII. Management Suggestions

This investigation requires nothing except the student worksheets and the construction of the "lunometer" shown on one of them. The investigation is most interesting if done around full moon. Full moon finds the moon rising at the same time the sun is setting...that is, they are in opposite directions as viewed from the earth.

VIII. Procedure

1. Divide the class into observaton groups. Since this is an evening activity, groups will have to live in the same neighborhood. If some students do not have partners, suggest that their parents help them as the readings are made.
2. Provide each group or individual with all of the student worksheets.
3. Have each student prepare a "lunometer".
4. Give students practice in using their lunometers by finding the angle of the tops of buildings, trees, etc.
5. Discuss the record sheet for recording the readings.
6. Instruct the students to watch for the moon to rise and carefully record the time. If there are mountains or other obstructions to the east they will also have to measure the beginning elevation of the moon as it rises. Observing the moonrise time the day before and adding 50 minutes to that time will predict the time it will rise on the evening of the experiment. Students can then be alerted to be ready at a relatively precise time.
7. Have students take readings every thirty minutes for a five-hour period. Special dispensation may be required from parents. Another alternative is to use a four-hour period.
8. Students will then compute the average movement in degrees per half-hour and hour. From this they will compute how long it will take to move through 360 degrees.
9. Students will graph the results in half-hour increments. Since the graph will approximate a straight line, students should observe that a uniform result is occurring. Therefore, the line can be extended until it reaches the 90 degree mark. At that point, one-fourth of the moon's rotation has been completed. By reading the time for that point, students can determine how long it takes for the moon to make one-fourth of its journey around the earth. Multiplied by four will give the approximate time for the next evening's moonrise.
10. Students will predict the moon's rising time for the four nights following the initial evening of observation, check it with the actual time, compute the differences, and find the per cent of error.

IX. Discussion

1. How accurately can we predict moonrise?
2. Which individual or group made the most accurate prediction? Why?
3. Could we predict when the moon will rise ten days from now? How?
4. What causes the moon to rise and to set?

M&M Math Continued...

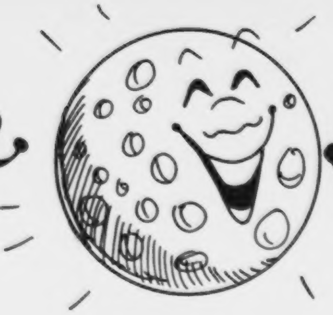
IX. Discussion

1. Do all of the M&M bags used in this activity contain about the same number of M&M's? How can you explain this?
2. Why do you think that there were more dark brown M&M's in the bag?
3. What combinations of two colors produced the greatest amount of M&M's?
4. How does the number of dark brown M&M's compare with the number of all of the other M&M's together?

X. Extensions

1. There are other products that can be substituted for M&M's such as cookies, crackers, breakfast cereals and other candies (jelly bellies).
2. Prepare different types of graphs-picture graphs, bar graphs, line graphs.
3. Prepare graphs of other types of activities in the classroom -ages, birth months, favorite pets, or favorite foods.

____
Name

The  Shines Bright

In the investigation, you will chart the movement of the moon for 5 hours beginning at moonrise. The best time of month is just before full moon. At full moon, the moon rises at the time the sun sets.

Carefully record the time the moon rises and make a measurement of its angle of elevation with your luneometer. This will be zero unless the moon rises behind hills or mountains. Repeat the measurement in every 30 minutes. Observe the timing with care. Enter the information into the table.

One person needs to point the lunometer at the moon and the other take the reading on the scale.

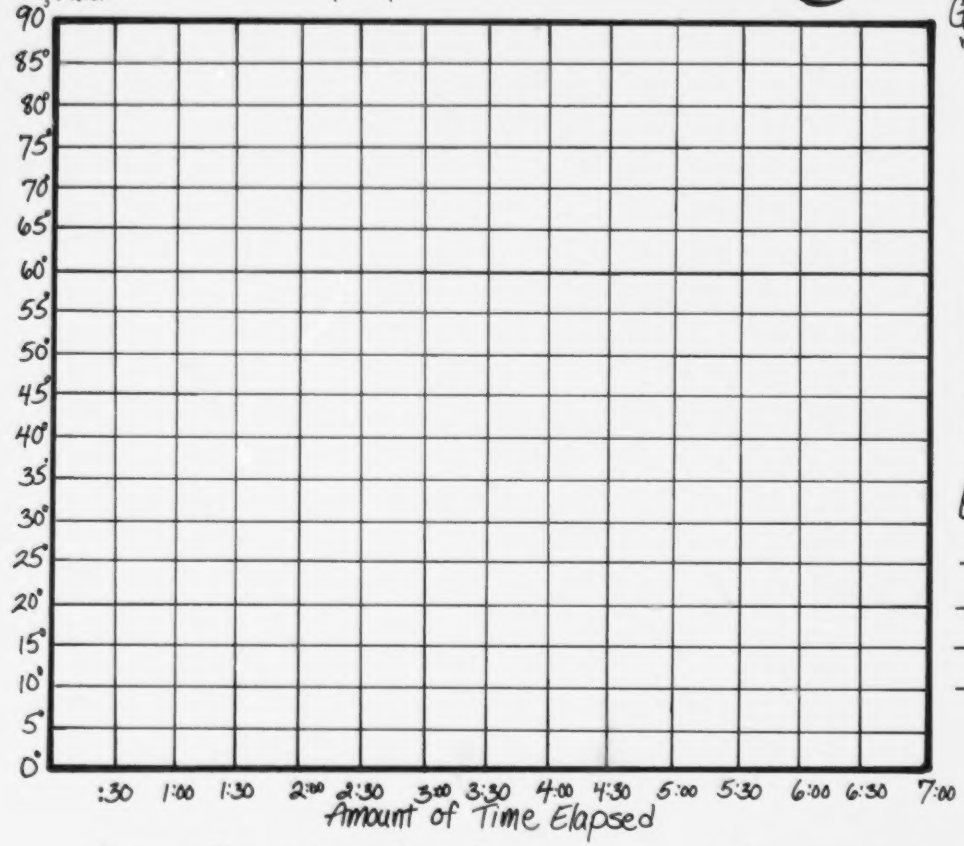
	Time	Angle of Elevation	Amount of Change in 30 minutes
moonrise:			

Total of Change: ☐

Average Change: ☐

Name ______________________

The Shines Bright



Graph the Results

How long (in hours and minutes) will it take to have a change of 360 degrees?

____

Explain: ______________________

____

____

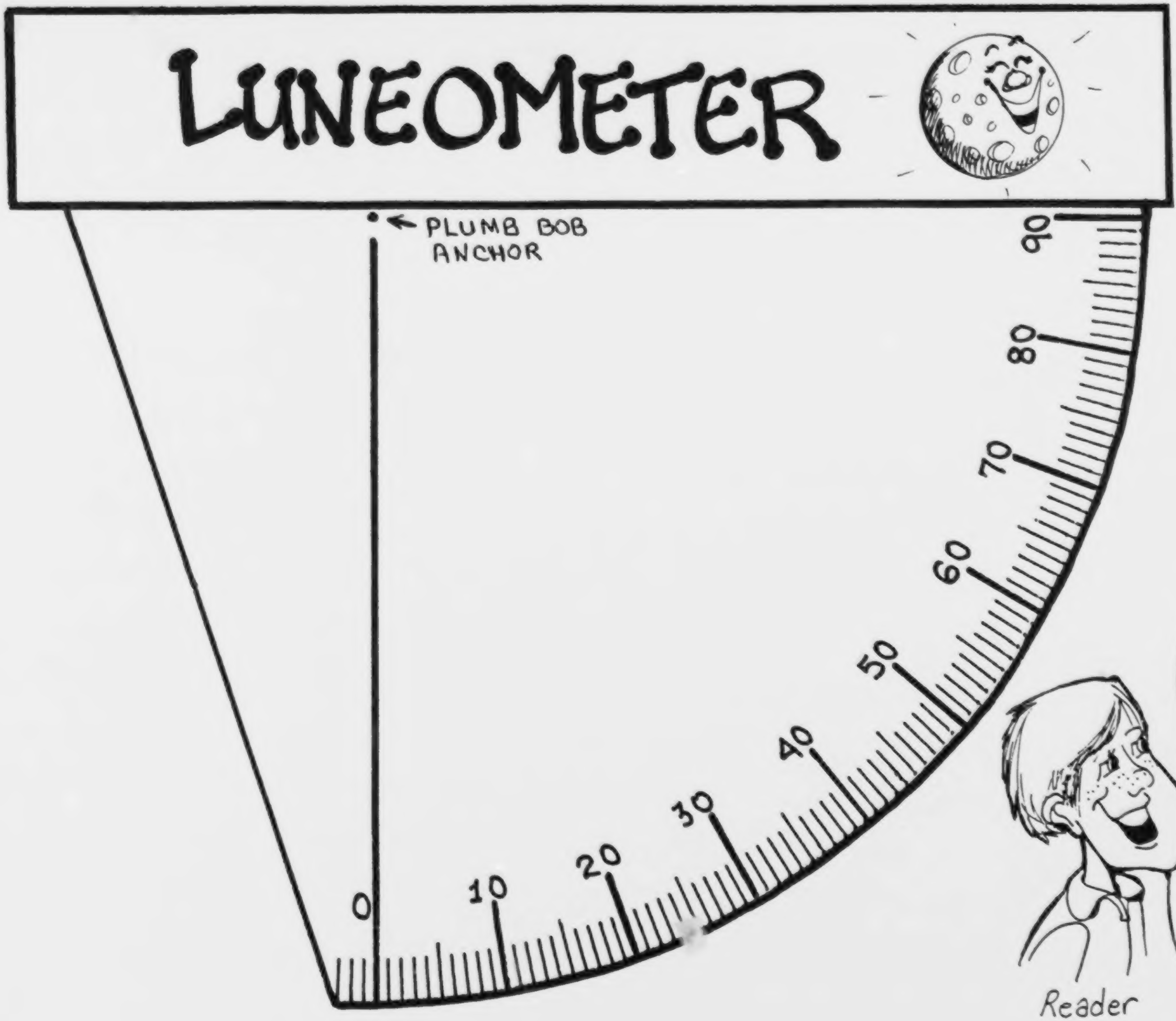
____

____

Using the information from your observation predict when the moon will rise in each of the 4 evenings following. Observe the actual rising time and compute your percent of error. Use the time of moonrise observed above for the first date.

Evening:	Date of Observation	Predicted Moonrise Time	Actual Moonrise Time	Difference in Minutes	Per Cent of Error
Initial (full moon)					
First					
Second					
Third					
Fourth					
			Totals:		
			Averages:		

Mimi '87



Sighter ____________

Reader ____________

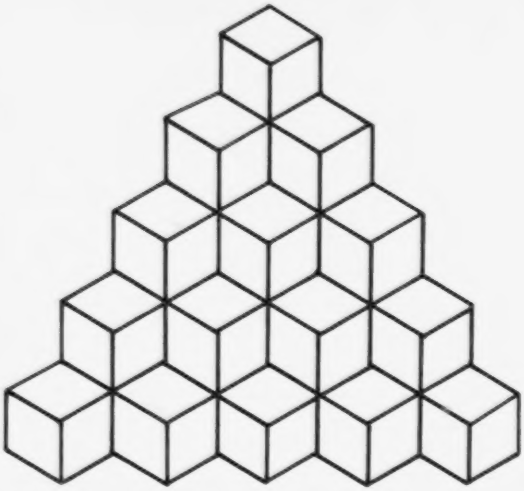
Recorder ____________

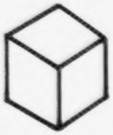
Tower of Cubes

The tower to the right is made of 35 cubes in 5 layers. How many cubes are needed to form a similar tower with 10 layers?

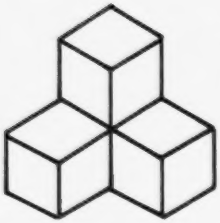
Solve this problem by first considering a tower with 1 layer, then one with 2 layers, etc. until you see the pattern that emerges.

Use a chart like the one illustrated to record your results.





1 layer



2 layers

NUMBER OF LAYERS	NUMBER OF CUBES
1	1
2	4
3	____
4	____
5	____
6	____
7	____
8	____
9	____
10	____
. .	. . . .
50	____
n	____

QUESTIONS:

1. How many cubes would the tower contain if it had 50 layers?
2. How many cubes would the tower contain if it had n layers?

BALANCING CLOWN

GENERAL INFORMATION

All objects have a center of gravity. The center of gravity is a point where all of the weight of an object seems to be centered. It is usually located at or near the center of an object. The center of gravity tends to move as low to the ground as possible.

Scientists are not really sure what gravity is, but they have learned a great deal about what it does. For the most part, scientists agree that gravity is a force which attracts one object to another. The earth's force of gravity pulls all objects down, but since our earth is almost round, down is toward the center. Objects are pulled toward the center of the earth until they are stopped by the ground, a table top, a floor, or some other object. An object does not tip over easily when its center of gravity is as close to the center of the earth as it can get. Every object has a center of gravity and can be made to balance. The point at which an object balances is called the balance point. When the center of gravity is below the balance point the object has more balance than when the center of gravity is above the balance point.

Race cars are built lower to the ground than passenger cars. This lowers the car's center of gravity and gives them better balance so they won't tip over when turning at a high rate of speed. Football players lower their body weight when blocking and tackling to give them better balance. Lowering their weight actually lowers their center of gravity. Tight rope walkers hold a long pole while on the rope. The pole bends downward at each end. This lowers the center of gravity and the person holding the pole has a much better balance than he/she would if no pole were used.

MATERIALS

Use the drawing of the clown on the student activity sheet for a pattern. You can glue it to a piece of tagboard and then cut around it or place a piece of carbon paper on the tagboard and cover it with the drawing of the clown. Trace around the clown so it is outlined on the tagboard. Multiple copies should be made (using a ditto or Xerox machine) so all students can have their own clown for experimentation.

After attaching a small piece of clay (or a piece of masking tape folded over to the hands of the clown, stick two equal weights, such as pennies, nickels, small washers, etc. on each hand of the clown. Use the rubber eraser on the end of a pencil for the platform on which to balance the clown.

PROCEDURE

1. Prepare the clown as described in the 'Materials' section above.
2. Attempt to balance the clown on its nose before attaching the weights.
3. Attach the weights as described in the 'Materials' section. Try different size weights and compare to find out if a certain weight works better than the others.

POSSIBLE ANSWERS

1. When attempting to balance the clown on its nose before attaching the weights, most of the weight is above the balance point (the clown's nose) so it cannot be balanced.
2. After attaching the coins or washers, most of the weight is below the balance point so the clown can balance on its nose.
3. The placement of the weights on the clown's hands lowers its center of gravity.
4. When a person or object lowers its center of gravity, its balance becomes more stable. This can be demonstrated by climbing a ladder. On the first step a person's balance is almost the same as if standing on the ground. As a person moves up the ladder, he/she can feel less and less balanced.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Have students suggest some of the ways that we can observe things adjusting their center of gravity to improve their balance. As indicated in 'General Information', they might suggest race cars being built with the chassis low to the ground, athletes getting in a crouched position to improve their balance when blocking, tackling, fielding a baseball, etc.

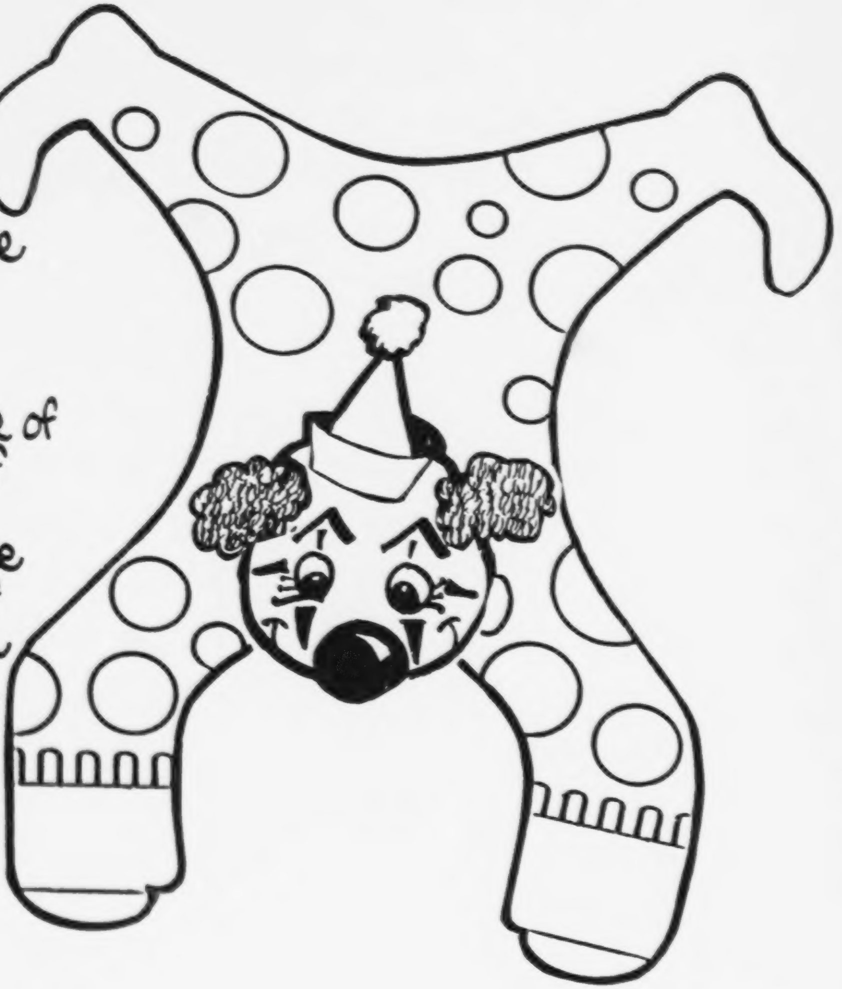
Some students have had the experience of carrying a long pole or board. It is easiest to carry if held at the midpoint which is its center of gravity.

Repeat the experiment with the clown. Instead of attaching the weight to the hand, attach a weight to one end of a 6" thread. Secure the other end to the hand of the clown with a piece of tape. Does the clown balance better with the weight 6" below the hand?

If there is a balance beam on the playground (some have a 2" x 4" board about a foot off the ground) have students walk the beam. Put about one pound of sand in each of two plastic gallon milk containers. Tie one container to each end of a long pole (about 6 to 8 feet long) so the containers hang about two or three feet below the pole. Walk the beam again holding the pole. Adjust the pole to different heights. What happens to the balance compared to walking the beam with the pole?

C.S.A. Innovative Curriculum Project/AIMS Education Foundation ©1987

Balancing Clown



Materials:

Clown
pencil
2 coins
Masking tape

Procedure:

1. Trace and cut an outline of of the clown on a piece of tagboard.
2. Hold the clown so its nose is resting on the eraser of a pencil. Let go when you think it is balanced.
3. Use a piece of masking tape to attach a penny to each of the clown's hands and then repeat procedure 2.

Questions:

1. When following procedure 2, was most of the weight of the clown above or below the balance point? Did it balance?

2. After attaching the coins, was most of the weight above or below the balance point? Did it balance?

3. What did the placement of coins on the clown do to the center of gravity?

4. What happens to the balance of an object (or person) when its center of gravity is lowered?

C.S.A. Innovative Curriculum Project/AIMS Education Foundation ©1987

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name ______________________________ Social Security No. ______________

Street ______________________________ City ______________

State ______________ Zip ________ Home Phone ( ) ______________

School District ______________________________

School ______________ Grade Level ________ School Phone ( ) ______________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

☐ Poway Unified School District, August 13-17
☐ Fairfield-Suisun Unified School District, June 22-26
☐ Edmonds (Washington) School District, June 29-July 3
☐ Ventura Unified School District, July 13-17
☐ Placentia Unified School District, July 13-17
☐ Mother Lode Union School District, July 20-24
☐ El Monte City School District, August 17-21
☐ Azusa Unified School District, August 24-28
☐ San Jose Unified School District, June 22-26
☐ Sacramento, date to be determined

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

- -

Out of This World Continued...

graphs over a longer period of time to show how the length of sunshine varies in different times of the year.

In *How High the Sun?* students measure the elevation of the sun at noon during various times of the year and graph this information on a protractor graph.

The third major movement of the sun is measure against the east-west line in *The East-West Angle*.

Our Source of Energy is a fact sheet giving interesting facts about the sun. For instance, the sun looses 6,000 tons of its mass every second!

If it Comes From Outer Space, Will it Float has students investigate the density of the planets, comparative composition, and determine which planets would float and which would sink if placed into an imaginary ocean large enough.

In *The Big Sky I* the students will develop models of several of the constellations and chart their location in the sky.

In *The Big Sky II* additional constellations will be studied and charted in this investigation.

Titles of the investigations in Book B may be changed in the final stages of editing but the general description of the content is accurate.

"Out of This World, Book A" may be ordered from the AIMS Education Foundation for shipment on or after February 25. The cost of the book is $10.95. Please add 10% for shipping, handling, and insurance. California residents add 6% sales tax.

Sacramento and Placentia Added to Summer Workshop Schedule

Invitations to host AIMS workshops in the summer of 1987 have been accepted from Sacramento and Placentia.

The Placentia Unified School District will host the one-week AIMS Workshop July 13-17. This will be a two-section workshop for K-3 and grades 4-6.

The details for the Sacramento AIMS Workshop have not yet been finalized. They will be announced in the February Newsletter. However, it will be a three-section workshop for grades K-2, 3-5, and 5-8.

Teachers from outside the school districts sponsoring AIMS Workshops are welcome to attend. All sponsoring districts have agreed to open the workshops to out-of-district teachers.

It is essential to pre-register. An up-dated form is included in this issue.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation
A Non-Profit Tax-Exempt Foundation

Volume I, Number 7 February, 1987 ©AIMS Education Foundation

AIMS Education Foundation Outlines Five-Year Plan

The program directors of the AIMS Education Foundation have developed a five-year master plan to guide the development of the AIMS program. Projections in the plan are built on the growth pattern of AIMS during its five-year history.

Five years ago, AIMS was in its embryonic stage...an idea being explored by the faculty and eighty classroom teachers involved in a National Science Foundation funded program at Fresno Pacific College. Lawrence Ecklund and Arthur Wiebe, the project faculty, led the group in examining the validity and potential of an integrated approach to the study of mathematics and science at the elementary and middle school levels.

From that beginning, AIMS has experienced rapid growth as it gained the enthusiastic endorsement of classroom teachers. Today, AIMS enjoys a highly favorable and increasingly widespread reception from all segments of the educational community: students, teachers, administrators, science and mathematics educators, State Departments of Education, and related educational agencies.

Already, tens of thousands of students in over 800 school districts are benefitting from the AIMS approach. Much of this growth has come through teacher-to-teacher recommendation. Key personnel in the State Departments of Education in California, Hawaii, Nevada, and Michigan have provided strong endorsement, support, and aid in dissemination. Scores of colleges and universities have incorporated AIMS into their science education programs. Distribution of AIMS materials is now national in scope.

It is important to emphasize two important aspects of AIMS: first, AIMS is a classroom-teacher movement to improve student performance in mathematics and science; and, second, the AIMS Education Foundation is a non-profit, tax-exempt foundation. No one receives royalties for authoring materials and no officer of the Foundation receives compensation for official duties. Tax-exemption has been granted both by the Federal Government and the State of California.

The founders and program directors of AIMS are convinced that the classroom teachers of America are the best resource for developing the mathematics and science curriculum. They know the diverse needs of students better than anyone else and are the best judges as to what students can and want to learn. They are also the best interpreters of how to adapt curricular materials to the classroom and how to manage classrooms. AIMS draws heavily from this expertise.

During the past five years, AIMS has published 17 AIMS books and 4 SETUP books. During the current year, the Foundation is publishing 5 science poster sets, 8 mathematics poster sets, and a minimum of 3 new AIMS books. Equally important is the evolving thrust of the materials. Today, AIMS materials integrate not only science and mathematics but add to the language arts and social studies. There is strong movement toward an integrated approach to learning.

In 1984, Fresno Pacific College began offering one-week AIMS workshops. By 1986 the enrollment in such workshops totaled more than 400 teachers with another 450 teachers receiving an introduction to AIMS in the Festival of Mathematics and Science. For the summer of 1987, the workshop schedule is being expanded greatly. In addition to the four workshops on the Fresno Pacific College campus, up to twelve will be offered at other locations. It is anticipated that the total enrollment in such workshops in the summer of 1987 will exceed 1500.

The AIMS Program for 1987-92

The AIMS program for 1987-92 is comprehensive in nature, national in scope, and broadly supportive for teachers using the materials.

Materials Development

AIMS is committed to a continuous program of materials development. Our task is the building of a comprehensive library of hands-on integrated math/science/language arts activities suitable for all types of students. Currently, two groups of writing teams are engaged in this effort. The Fresno group is nearing completion of its current two-year effort which will produce books dealing with simple machines, the solar system, changes in matter, probability and statistics, microscope investigations, electricity and magnetism, and living and non-living things.

The teams meeting in Huntington Beach are writing in the areas of logic, sound, consumer education, and materials for primary students. The AIMS faculty and some of the writers are nearing completion of a book for use at the primary level that centers around the Teddy Bear theme.

A change in the selection of writing team members is being instituted for the future. Specific topics will form the focus of small group writing projects and writers will be selected with strong background in these specific

(see Five-Year Plan, Page 4)

AIMS National Leadership Network Introduces Fran Threewit

Fran Threewit's first principal told her she "had stars in her eyes." That was twenty-five years ago and we can still see them shining brightly today. Currently Fran finds herself very busy as a math mentor teacher in the Santa Rosa City Schools and a very popular Project AIMS Workshop leader in Northern California. She has recently conducted successful workshops in Fairfield, Booneville, Monroe Elementary School in Santa Rosa, and in Sonoma and Marion counties. She is a member of the Fresno Pacific College adjunct faculty and will be teaching in the Summer '87 Math Festival and AIMS Math/Science workshops.

Fran conducts frequent AIMS workshops.

Fran's enthusiasm for learning is evident in her workshop presentations as she so energetically gets everyone involved. Her experience in the K-6 classroom reflects 25 years of joyful teaching...and she spontaneously shares with others many innovative and successful ideas from that background.

She also is a member of the California Math Initiative Committee, and is secretary of the California Math Council-Northern Section.

We are proud to include Fran Threewit in the family of AIMS leaders!

Shadows tell us about the Sun.

She had tender loving care is a standard ingredient, Fran Threewit.

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California **93747**. Volume I, No. 7.

EDITORS	Arthur Wiebe, Judith Hillen
STAFF ARTIST	Sheryl Mercier
OFFICE MANAGER	Sheryl Bishop
PROGRAM DIRECTORS:	
Fresno Pacific College Math/Science Project	Lawrence E. Ecklund
AIMS Education Foundation	Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes	Ted Ostrander
Project AIMS	Judith Hillen, Arthur Wiebe
Project SETUP	Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION

PRESIDENT	Arthur Wiebe, Ed.D.
VICE-PRESIDENT	Wilbert Reimer
SECRETARY	Lawrence Ecklund
TREASURER	Jon Hillen
ACCOUNTANT	Robert J. Dwyer
STAFF ARTIST	Sheryl Mercier

• THIS ISSUE • THIS ISSUE • **IN SUMMARY** • THIS ISSUE • THIS ISSUE •

Five-Year Plan for AIMS

The rapid acceptance of the AIMS program makes it essential to formulate a long-range plan of development to ensure quality. **See story, Page 1.**

New Mathematics Poster Series Introduced

A second mathematics poster series dealing with content appropriate for grades 3-8 is introduced in this issue. **See story, Page 6**

1987 Festival of Mathematics

This summer's Festival of Mathematics offers the most comprehensive program in the seventeen-year history of this annual event. An outstanding program has been designed. **See Page 10.**

Microscope Activities Introduced

One of the current writing projects focuses on studies with the microscope. In this issue, one of the activities developed by Mike Woods is presented as a preview of the series that is emerging. **See Page 15.**

Eggs by the Dozen

Two investigations dealing with eggs together with the eggs fact sheet should provide an unusual experience for your students. **See Page 18.**

Science Poster Studies Card on a Spool

This month's science poster deals with a Bernoulli's Principle. It will surprise some of your students and they, in turn, will want to amaze their parents. **See page 25.**

Triangular Numbers Form an Oft-Appearing Set

This month's mathematics poster in the series authored by Wilbert Reimer has students become familiar with triangular numbers. This set of numbers occurs in many mathematical situations. **See page 27.**

Do All Pennies Have Approximately the Same Weight?

You and your students will discover the surprising answer when you complete the "Common Sense" investigation. And, don't forget to use the information from the investigation for some interesting problem applications. **See Page 29.**

More Summer Workshops Announced

The AIMS Education Foundation has approved two more workshops for the summer of 1987: Hesperia and Goleta. The information about all of the workshops and the pre-registration form is on **Page 31.**

AIMS Staff Expanded

The work of the AIMS Education Foundation is expanding rapidly and the staff to support the program directors is growing to meet this need. **Story on Page 32.**

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten issues will feature the following:

Three new AIMS investigations one at each of these grade levels: K–2, 3–5, and 5–9; one 8.5 × 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS is a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscriptions will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. Because a year's subscription will provide 30 or more new investigations plus 10 mathematics posters and 10 science posters, the cost is less than that of purchasing these materials separately!

Subscription Information:

Name: ______________________________

Address: ______________________________
Street City
____
State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, California 93747

202

Five-Year Plan, continued...

topics. The topics will be selected from those in the California State Mathematics and Science Frameworks, the various Model Curriculum Standards, and similar foundational documents. Several such teams will be selected during the Spring of 1987 to begin work in the summer and fall. **Readers interested in future writing projects are invited to communicate their interest to the AIMS program directors.**

A basic element of the master plan calls for the number of AIMS book titles in print to double during the next five years and for the completion of two series of mathematics posters and the series of science posters. Each series will consist of 20 sets of five posters each. The purpose of the posters is to create student interest and involvement in problem solving activities in mathematics and hands-on investigations in science.

Leadership Training

The demand for trained leaders to make conference presentations, conduct one-day and one-week AIMS workshops, and serve as consultants to schools implementing AIMS is mushrooming. It is the intention of the AIMS Education Foundation to build a large cadre of teachers as members in the AIMS National Leadership Network to assume such responsibilities. Currently, the Network has 24 members who have had extensive experience in the AIMS program and demonstrated their leadership qualities.

Network standards are high. Members are expected to have a sound understanding of mathematics and science and be stimulating workshop leaders with thorough experience in using AIMS in their own classrooms. Membership is restricted to persons with classroom teaching experience.

Currently, the AIMS National Leadership Network training program has an enrollment of 73 teachers. Launched in the summer of 1986, the program encompasses 300 clock hours of instruction in mathematics and science topics and 100 hours of staff development field work, all spread over a two-year period. Those participants from this program who met the rigorous standards for admission will become members of the AIMS National Leadership Network.

Photographs on these two pages are those of trainees for the AIMS National Leadership Network. Left to Right-Jodi Jones, Doug Greene, Kathie Mittman, Porterville Public Schools.

Left to Right-Sherrin Pratt, JoAnn Philbrick, Bishop Union School District.

To meet the demand for further serving both in-state and out-of-state teachers, a new cycle for this program has been announced for 1987. Published originally in the August issue of the AIMS Newsletter, it appears again in this issue.

Readers interested in enrolling in this cycle should submit their applications as early as possible.

The faculty for the off-campus workshops offered this summer will be selected from the members of the Network and from candidates in the current training program who have demonstrated their leadership qualities.

During the next five years additional cycles will be offered.

Classroom Teacher Training and Support

Training must be made available for classroom teachers who want to become more knowledgeable in mathematics and science. The on-campus and off-campus AIMS Workshops, the Festival of Mathematics, the Science Festival, and the Computer Institutes offer valuable training. Assembled for these programs are some of the nation's leading mathematics and science educators. In its sixteen-year history, the Festival of Mathematics has attracted more than 3,000 participants from all parts of the nation. The 1987 program offers the most comprehensive in its history.

But another request is emerging. Teachers want to have continuous, in-depth instruction in selected topics in mathematics and science. In response, AIMS intends to initiate courses such as "Topics in Physics for Elementary School Teachers."

Television and Video-Tape Series

Initial planning for launching the development of a 15-program television series has been completed. Preliminary work on the content and format is underway. The purpose of this program is to provide in-service training for teachers who are implementing AIMS. The philosophy, learning model, classroom management formats, approach, and content of AIMS will be the focus. Each program will consist of a half-hour telecast. The same material will be available in video-tape format for purchase by school districts.

Left to Right-Valerie Lake, Sacramento City Schools, Pat Stump, Jim Sherblon, Lodi Unified.

Kathryn Kendig, a veteran and accomplished television producer, has been selected to develop the format, content, and script for these programs. She already has an award-winning television series to her credit.

This series will be developed over a two to three year period. When completed it will be aired by television stations reaching all parts of California and available for telecasting throughout the nation. In the 1978-81 period, the Fresno Pacific Math/Science Project aired the "Open Math" program developed at Arizona State University on more than a dozen California TV stations. That experience will serve as the foundation for even more comprehensive regional class sessions taught by Network members which will provide opportunities for feedback, discussion, and additional instruction.

Information Dissemination

In response to hundreds of requests to "keep me informed", the AIMS Education Foundation launched the publication of a ten-issue per year AIMS Newsletter. The purpose was to announce programs, workshops, and new publications; and to disseminate new AIMS activities prior to the time they would be available in new AIMS books. Response to the Newsletter has been enthusiastic and the subscription list grows daily. The goal is to reach the 10,000 subscription mark during the next five years.

We invite AIMS enthusiasts to help us reach that goal as rapidly as possible. The larger the number of subscribers, the more the Newsletter will be able to offer.

The AIMS Newsletter is more than a provider of information. It is a platform from which teachers, schools, and districts with distinctive efforts in mathematics and science education can tell their story. **Individuals are encouraged to submit articles describing what is happening in their classrooms and schools as they use AIMS.**

The Newsletter is envisioned as the principle instrument for the dissemination of information about AIMS.

Information Workshops

There exists a widespread demand for AIMS information workshops for teachers who want to become acquainted with the program. Despite numerous presentations by the program directors of AIMS, the demand exceeds the capability of being met by the current efforts. In response, it is planned to enlist members of the AIMS National Leadership Network to offer an extensive series of such workshops beginning in the fall of 1987. These will generally be conducted as all-day Saturday sessions. The principle emphasis will be the introduction of the underlying principles of AIMS, experiences with AIMS hands-on activities, and discussions of implementation.

Educational agencies desiring to co-sponsor such informational sessions are invited to contact the Foundation.

Research and Development

An essential element of the AIMS program is the research and development effort. Up to this point this has been carried only by the writers and program directors. Additional support is needed. In response, the Foundation has established a position in research and development and appointed D. Scott Clevenger to that post. Scott is a pre-med student at Fresno Pacific College with extensive training in biology, chemistry, mathematics, and computer science. It is anticipated that this program will be expanded periodically during the next five years.

The National Mission

If the growth of the past five years is used to project the growth in the next five years, then it is inevitable that AIMS will become a major factor in mathematics and science education at the national level. It is, therefore, incumbent upon the Foundation to develop adequate plans and programs to preserve essence, integrity, and philosophy of AIMS and, above all, to keep it as a classroom teacher movement.

The Fascinating Triangle

Arthur J. Wiebe

In this issue of the Newsletter we are introducing a new regular feature: problem solving explorations designed for grades 3 and up. The owl is the symbol of the first series authored by Wilbert Reimer, which we will continue to feature. The squirrel is the symbol for this new series.

The first problem that will be explored is one which you may have used with your students since it has been widely disseminated. However, we will both expand the exploration and add challenging new dimensions.

This problem explores a microworld with just three features:

a. One rule governs the generation of all answers;
b. The map consists of a simple arrangement of six circles to form the legs of an equilateral triangle; and
c. Six moveable numbers are used for placement in the circles.

In our introductory investigation we will use the numbers 1, 2, 3, 4, 5, and 6.

The rule for generating answers is:

Place the six numbers in the six circles so the sums of the three numbers on each leg of the triangle are equal.

Students should each have the map shown on page 9. In addition, they should be given six chips with the numbers 1-6 on them. A variety of such sets are shown on page 8. If these are mounted on card stock and cut out, they make convenient moveable chips; or, they may be cut out and mounted on bottle caps or other round objects that make them easy to handle. The discs can be snapped into the bottom of some types of plastic milk bottle caps.

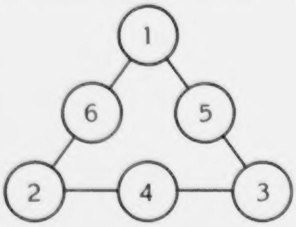
Students need to be challenged to find all possible sums. As they begin this exploration, their most likely method of attack will be trial and error. Trial and error is a valuable and legitimate problem solving tool and is often used to learn about the parameters of a problem.

Students will test various arrangements. Some results will be accepted; others will be discarded because they do not fit the rule. Using chips such as those recommended here means that trials which are not acceptable leave no trace of error. Robert Wirtz was a strong advocate of problem solving activities which permitted free exploration without fear of leaving a trace of error. Such traces are demoralizing to students and reduce their motivation.

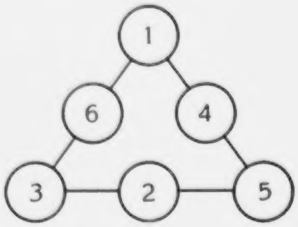
This is a good beginning activity because it has only four solutions. But even four solutions to one problem is more than most of the mathematics experiences provide.

In the process of discovery, the finding of different sums should form the primary objective. The number arrangements themselves may be rotated or reflected within the triangles but that is of secondary importance for the moment. It can be discussed later.

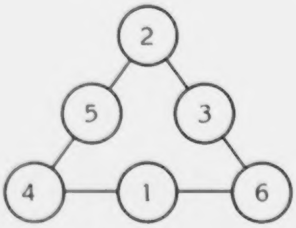
The four solutions are:



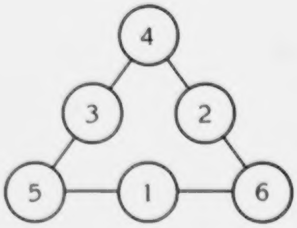
sum of 9



sum of 10



sum of 11



sum of 12

If, for example, students have found sums of 9, 10, and 12, someone may ask, "Is a sum of 11 possible?" This type of question helps focus the next step in the exploration: The search for the solution with a sum of 11.

Typically, students (as well as teachers meeting this problem for the first time) will continue to try to find sums other than 9, 10, 11, and 12. This provides an excellent opportunity to move the approach from trial and error to logical thinking. If the teacher or student poses the question, "Is there an arrangement that yields the sum of 8?" the door to logical thinking is opened.

After a fruitless search for solutions by trial and error, someone may come up with reasoning such as the following.

The "enemy" of a sum of 8 is the largest number being used, namely 6.
Somewhere, we must use 6.
Two other numbers must be used with 6.
In order to obtain the smallest sum, we will choose the two smallest numbers available to go with 6: 1 and 2.
But 6+1+2=9.
Therefore, 8 is not possible and 9 is the smallest sum.
Is a sum larger than 12 possible?
Now a series of statements that are a "reflection" of the previous set is useful.
1 is the "enemy" of obtaining a larger sum.

1 must be used in conjunction with two remaining numbers.
The largest remaining numbers are 5 and 6.
But 1+5+6=12.
Therefore, 13 is not possible and 12 is the largest sum.

Since this is the beginning of a much larger series of investigations, students might be taught to develop an informal proof such as the following.

Each statement must consist of only one assertion and the truth of this assertion should be self-evident.

This informal proof lists the statements which show that a sum of 8 is not possible.

1. A set of three numbers must be used in each leg of the triangle.
2. 6 must appear in one of the number sets.
3. 6 must be used together with two other numbers.
4. The other two numbers used with 6 must be the smallest available.
5. The two smallest numbers still available are 1 and 2.
6. 6+1+2=9.
7. Therefore, 9 is the smallest possible sum.

Informal proofs such as these are good preparation for the more formal proofs that will be encountered later in mathematics.

Satisfied that no other sums are possible, students should be encouraged to look for patterns in the four solutions. Here are some they may discover.

1. The numbers at the vertices have twice as powerful an effect as those in the center of each leg since they are used twice.
2. The smallest sum is obtained when the smallest numbers are placed at the vertices; and the largest sum is obtained when the largest numbers are placed at the vertices.
3. The triangle with the sums of 9 and 12 are "reflections" of each other. The numbers at the vertices in the "9" arrangement are in the center in the "12" arrangement and vise versa.
4. Similarly, the "10" and "11" triangles are reflections of each other. In the "10" triangle, the odd numbers are at the vertices and the even numbers are in the center spaces. In the "11" triangle, the even numbers are at the vertices and the odd numbers in the center spaces.

There is another approach to the finding of all possible sums. If we add the numbers 1-6 we obtain the sum 21. Vertex numbers are used twice, once on each of two legs, and thus their effect is doubled. If we use 1, 2, and 3 at the vertices, we can add their sum to 21: 21+1+2+3=27. Since this total will be divided among the three legs, we divide 27 by 3 to obtain 9 as the sum along one leg.

Similarly, if we used 4, 5, and 6 at the vertices we add 21+4+5+6=36. 36 divided by 3 yields 12. Also, if we use the odd numbers at the vertices we add 21+1+3+5=30. 30 divided by 3=10. And, if we used the even numbers at the vertices we add 21+2+4+6=33. 33 divided by 3 is 11. This approach will become increasingly important as the series of investigations continues.

What would happen if we changed the selection of numbers in this microworld? Would we still get such interesting results?

Here are some suggested number sets for further explorations:

1. The first 6 odd numbers: 1, 3, 5, 7, 9, 11.
2. The first 6 even numbers: 2, 4, 6, 8, 10, 12.
3. Multiples of 3: 3, 6, 9, 12, 15, 18.
4. Multiples of any counting number.
5. Number sets in which a given number is added to each successive element in the sequence. For example, beginning with 3 and adding 4 each time: 3, 7, 11, 15, 19, 23.
6. Fractional numbers. These must be selected with care. Either they must consist of regularly constructed multiples of the first; have a regular interval; or consist of a combination of the above. Here are two excellent sets that provide extensive drills in the addition of fractional numbers. The first consists of a sequence involving sixth: 1/6, 2/6, 3/6, 4/6, 5/6, and 6/6. Students who have not been exposed to addition of fractions with unlike denominators would use these fractions. Students who are ready to add fractions with unlike denominators would be provided with their equivalents: 1/6, 1/3, 1/2, 2/3, 5/6, and 1.
7. Another set of fractional numbers providing good drills while engaging in this problem-solving activity is: 1/8, 2/8, 3/8, 4/8, 5/8, and 6/8; or its equivalent with unlike denominators: 1/8, 1/4, 3/8, 1/2, 5/8, and 3/4.
8. Twelfths provide additional practice with unlike denominators: 1/12 to 6/12, or 1/12, 1/6, 1/4, 1/3, 5/12, and 1/2. Of course, the sequence can begin anywhere such as the range from 3/12 to 8/12.
9. Mixed numbers can be selected. Take for example the sequence: 1/3, 2/3, 3/3, 4/3, 5/3, and 6/3 or its equivalent, 1/3, 2/3, 1, 1 1/3, 1 2/3, and 2; or 1/4, 2/4, 3/4, 4/4, 5/4, and 6/4 or its equivalent of 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2.
10. Decimals formed as a sequence constitute another possibility. Take for example a set that consists of multiples of .35: .35, 1, 1.05, 1.4, 1.75, 2.1.

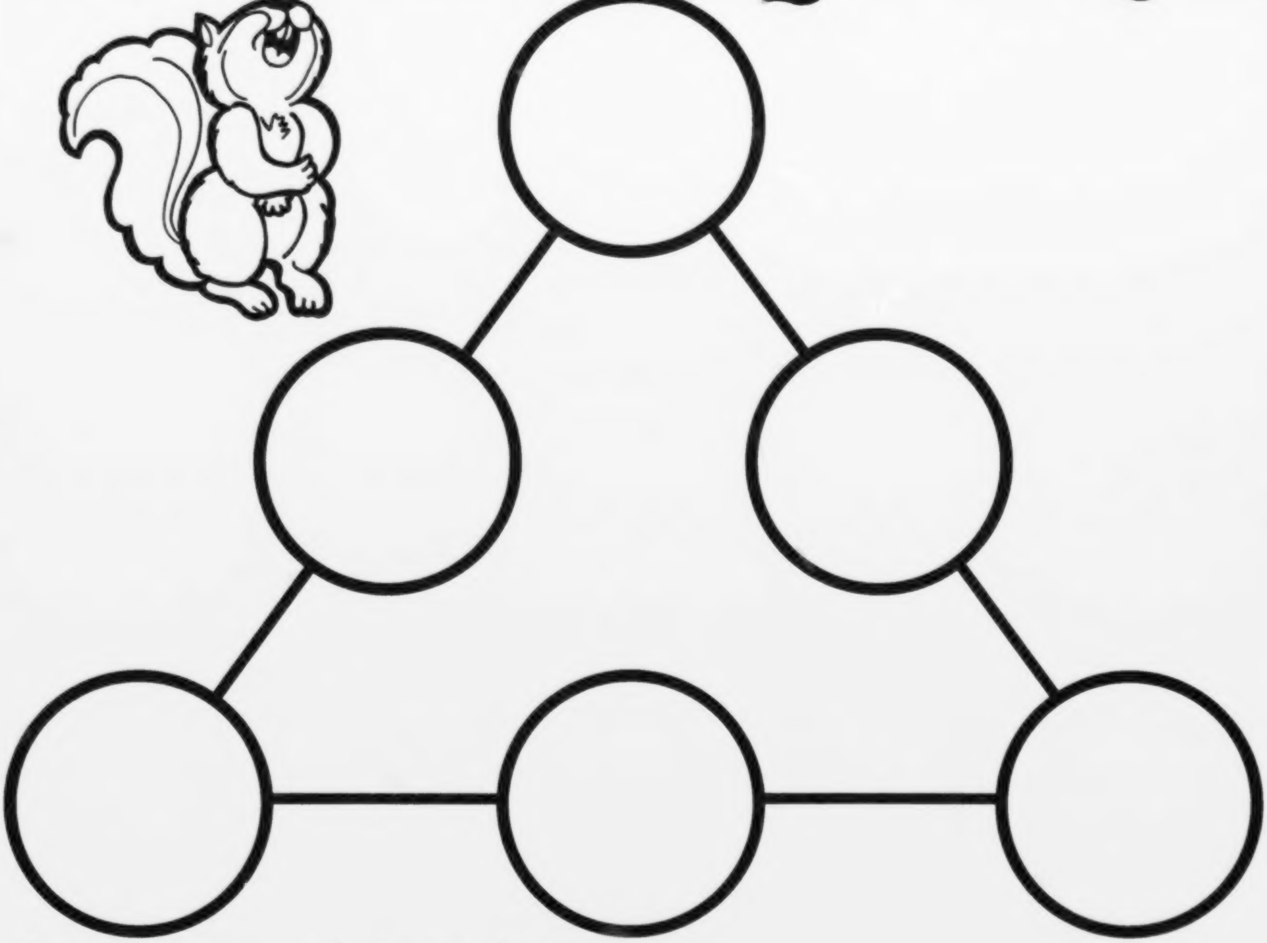
General results may be explored by students familiar with algebra. Sets such as this might be tested:

1. $x+4,\ 2x+8,\ 3x+12,\ 4x+16,\ 5x+20,\ 6x+24$
2. $x+y,\ ax+by,\ 2ax+2by,\ 3ax+3by,\ 4ax+4by,\ 5ax+5by$

In the next issue, we will extend this type of investigation to a more advanced microworld. In the meantime, your students can have abundant drills with the number sets indicated and others that they select for this microworld and at the same time experience the thrill of finding solutions to a problem solving environment.

1	2	3	4	5	6
1	3	5	7	9	11
2	4	6	8	10	12
3	6	9	12	15	18
$\frac{1}{6}$	$\frac{2}{6}$	$\frac{3}{6}$	$\frac{4}{6}$	$\frac{5}{6}$	$\frac{6}{6}$
$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{1}{1}$
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$

The Fascinating Triangle



Record your solutions here.

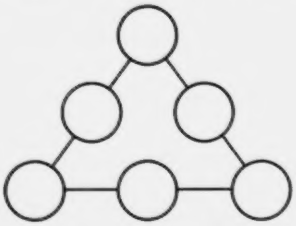
Use six numbers from one of these sets. Arrange them in the triangle so the sum along each side (leg) is the same.

FIND ALL POSSIBLE SUMS.

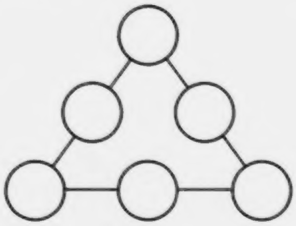
Set A: 1, 2, 3, 4, 5, 6

Set B: 1, 3, 5, 7, 9, 11

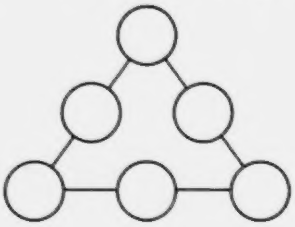
Set C: 2, 4, 6, 8, 10, 12



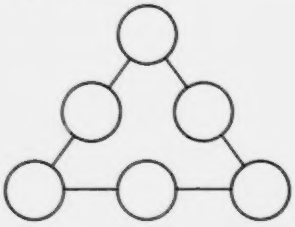
Sum:______



Sum:______



Sum:______



Sum:______

Are there any more?

L. MAY S. BEZUSZKA J. HILLEN L. ECKLUND A. WIEBE J. KNAUPP

Fresno Pacific Math-Science Project announces the

1987 FESTIVAL OF MATHEMATICS

June 22—July 3, 1987

Themes: Problem Solving in Mathematics
Integrating Mathematics and Science

4 SEMESTER UNITS OF CREDIT—IN-SERVICE OR GRADUATE

Designed especially for:

- ★ **Innovative Elementary Teachers**
- ★ **Mathematics Resource Teachers**
- ★ **Problem Solving Oriented Secondary Mathematics Teachers**
- ★ **Mathematics Supervisors**
- ★ **Curriculum Coordinators**
- ★ **Computer Using Teachers**
- ★ **Math Workshop Leaders**

Major Presenters

- LOLA MAY prescribing treatment for trouble spots in elementary mathematics during two stimulating, idea-packed general sessions daily, one for K-3 teachers and the second for teachers in grades 4-9.
- VALERIE WELK drawing upon her extensive experience and creative talent in teaching K-1 to share a wealth of innovative, interesting, and practical ideas and materials to enrich instruction in Kindergarten.
- KAY FLETCHER emphasizing critical and creative thinking in relation to mathematics and science through Project AIMS...she fondly calls Kinder-AIMS.
- LARRY ECKLUND sharing scores of "happenings" together with appropriate teaching strategies for grade 2 with an emphasis on concept development, problem solving, sequencing and curriculum development.
- FRAN THREEWIT presenting to third grade teachers many practical applications to their mathematics program by endless resources of hands-on mathematics activities.
- JONATHAN KNAUPP enriching the grades 4-5 mathematics curriculum with a host of stimulating instructional activities and strategies such as those he has incorporated into the OPEN MATH television series.
- JUDITH HILLEN providing stimulating ideas and enrichment for grades 5-6 with a variety of hands-on activities dealing with patterns in numbers, problem solving strategies and the integration of math into other curriculum areas.
- ARTHUR WIEBE presenting a practical, contemporary mathematics curriculum for grades 7-9 with an emphasis on problem solving, informal geometry, and the integration of mathematics and science.
- STANLEY BEZUSZKA bringing his expertise, creativity, and extensive experience in developing problem solving materials and in teaching problem solving to this strand designed especially for secondary math teachers.
- JIM WILSON providing participants with the opportunity to experience problem solving using carefully selected software and the materials developed in Project SETUP to integrate these into the curriculum.
- WILBERT REIMER presenting strategies for problem solving and demonstrating that problem solving is an exciting and exhilarating experience.
- DAVE YOUNGS providing a broad range of "hands-on" integrated math-science investigations selected from the AIMS activities.

V. WELK W. REIMER J. WILSON F. THREEWIT K. FLETCHER D. YOUNGS

Festival of Mathematics

The Festival of Mathematics has gained national recognition as an inspiring, challenging, and valuable experience, meeting the needs of elementary and secondary teachers for effective and relevant materials and methods of instruction.

It features some of America's leading mathematics educators, each of whom frequently works with students in the classroom.

This year's Festival offers the richest program in the sixteen-year history of this unique annual event that has been attended by more than two thousand teachers from all parts of the nation. It is an opportunity that you will not want to miss!

The 1987 Festival of Mathematics has been expanded to offer nine full strands of experiences, each designed for teachers of a specific grade-level range. Participants will select one strand most appropriate to their needs and participate in each of its four daily sessions. Evening sessions are optional but offer additional enriching experiences.

GENERAL SESSIONS WITH LOLA MAY

Dr. Lola May is the speaker at daily general sessions for K-6 teachers.

Lola is probably America's most listened to elementary school math educator. Her sparkling wit, sense of humor, first-hand knowledge of how children learn, her deep caring for children and teachers, and her mathematical insights are all combined to make each general session an experience you will never forget!

She is a speaker at most major math conferences, the author of countless articles in educational journals, the co-author of a K-8 mathematics series, and widely sought after math consultant. She has taught nationally televised math courses, college courses for teachers, and numerous in-service courses.

Lola May is returning to the Festival of Mathematics for the fifteenth year as its general session speaker. This is your opportunity to meet her in the special environment offered by the Festival of Mathematics.

KINDERGARTEN STRAND

Valerie Welk teaches kindergarten in the Clovis Unified School District. She has taught extensively at Fresno Pacific College and California State University of Fresno for the past thirteen years, working with teachers in Early Childhood Education programs. Valerie is a speaker at many conferences that emphasize Early Childhood Education, bringing her inexhaustible supply of creative ideas to primary teachers throughout the West.

Valerie brings creativity to the Kindergarten strand and she will be working with Kindergarten teachers only during the Festival of Mathematics. Themes to be explored include Attributes, Seriations, Numeration and Calendar Concepts. Each day will feature a new month of the school year with materials and learning activities provided for that month . . . ten months in ten days!

Imagine . . . ten days of instruction by Valerie Welk and Lola May! This stimulating combination must be experienced in order to be appreciated.

FIRST GRADE STRAND

Kay Fletcher will be the instructor for the First Grade Strand; many of the first grade teachers have wanted to have a session just for first grade teachers during the Festival of Mathematics and so we are honoring that request this year.

Kay joins us from Huntington Beach City Schools with an impressive seventeen years teaching experience in grades K-1. She is a recipient of the WHO (We Honor Ours) Award from California Teachers Association and the 1983 recipient of Teacher of the Year recognition in the Huntington Beach School District. Currently she is a mentor teacher utilizing a grant she received to implement a project that emphasizes critical and creative thinking in relation to mathematics and science through Project AIMS . . . a project that she fondly calls Kinder-AIMS. Kay brings a great variety of successful experiences and expertise for this year's Festival of Mathematics.

SECOND GRADE STRAND

Larry Ecklund is the instructor for this strand. Larry has a broad background as an elementary teacher, administrator, mathematics consultant for the Fresno County Department of Education; mathematics conference speaker, author of numerous articles and materials; extensive experience in teaching in-service and graduate courses; and director of the Fresno Pacific College Mathematics/Science Project. During each session there will be an emphasis on "HAPPENINGS" as a way to integrate mathematics and science and other areas of the course of study in a meaningful and practical fashion. Scores of effective and interesting "hands-on" activities will be presented and experienced.

THIRD GRADE STRAND

Fran Threewit provides a rich addition to the primary thrust of the Festival of Mathematics. Third grade teachers will be treated to many practical applications to their mathematics program by Fran's endless resources of hands-on mathematics activities. Fran has served as a curriculum leader in primary education at the Santa Rosa City School District. Fran has provided in-service oppor-

tunities in Northern California utilizing Family Math Activities and the AIMS (Activities to Integrate Mathematics and Science) Program. She has participated in many of the California Mathematics Council's conferences as speaker, workshop leader, and officer. Teachers attending the third grade strand will receive many new and useful ideas on the integration of math and science into their total instructional program.

FOURTH-FIFTH GRADE STRAND

Dr. Jonathan Knaupp teaches this strand. He is Associate Professor of Education at Arizona State University; the co-author of the *OPEN MATH Resource Book*, the OPEN MATH television series, *Patterns and Systems of Elementary Mathematics*, and *Parents and Children and Math*. He teaches staff development programs stressing the psychology of success and positive mental attitudes. Jonathan will present a rich variety of activities from "Numeration to Rockets". If you want practical and classroom tested applications of mathematics with the masterful touch, you will certainly want to experience Jonathan's sessions!

FIFTH-SIXTH GRADE STRAND

Judith Hillen is the instructor for this strand. She is the Director of Project AIMS and has a strong background in mathematics and science education. Judith has taught in elementary schools in California and Oregon, and has extensive experience as a workshop leader and teacher of in-service and graduate courses.

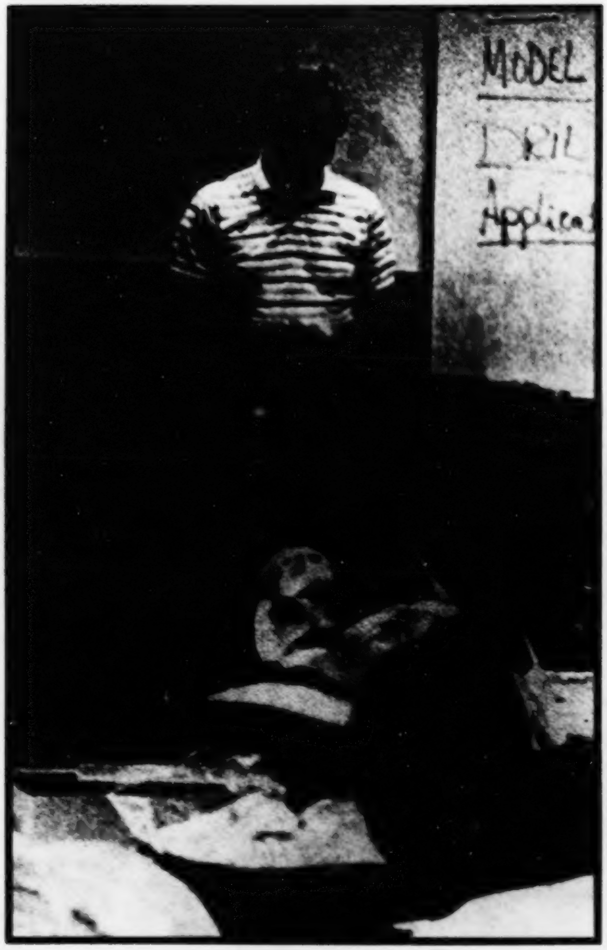
In this strand the topics of numbers and operations will be addressed to develop understanding and strengthen computational skills. A broad range of instructional materials will be provided each participant with suggestions for use in developing basic math competencies. Special attention will be given to problem solving strategies, patterns in numbers, and inductive and deductive reasoning.

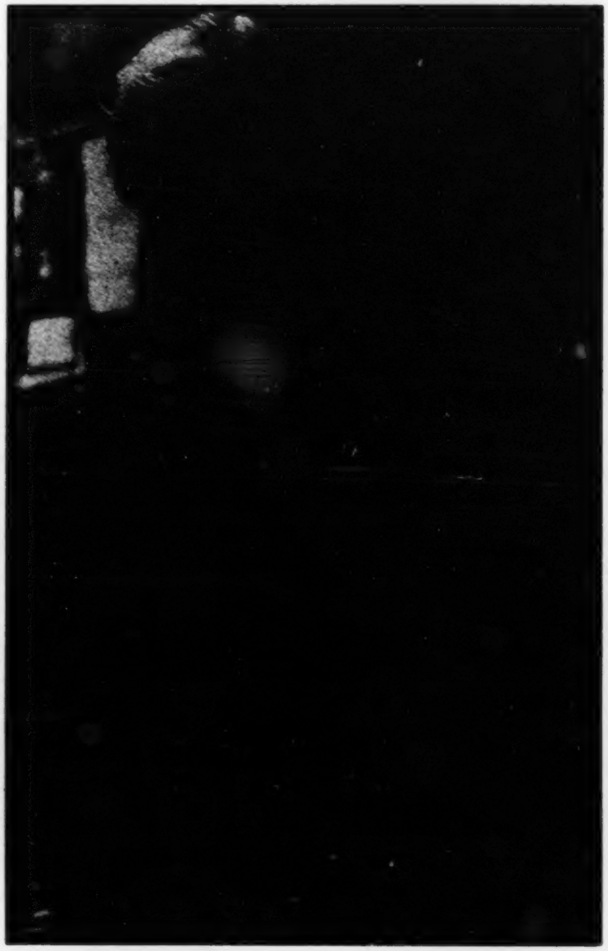
During these sessions applications of mathematics will take on new meaning as participants will be involved in "hands-on" situations that integrate mathematics with other areas of the curriculum—Project AIMS activities.

SEVENTH-EIGHTH-NINTH GRADE STRAND

Dr. Arthur Wiebe is the instructor for this strand which is designed for seventh, eighth, and general mathematics teachers at the ninth grade level. Arthur has a strong background in experimental work with junior high and general mathematics students. He is the author of two general mathematics texts and numerous other works and is director of the AIMS Project. He served on the National Council of Teachers of Mathematics writing team that produced Experiences in Mathematical Discovery.

During these sessions Dr. Wiebe will provide systematic treatment of a contemporary mathematics curriculum for these grade levels, sharing a broad range of tested activities for building understanding, developing problem solving abilities and computation skills. Additionally, in these sessions, Dr. Wiebe will provide many rich "situational lesson" experiences. Situational lessons are now stressed in the new Mathematics Framework for the state of California, and the materials incorporated here meet the expectations of this new emphasis. Many of these will be drawn from AIMS Project materials. By integrating mathematics and science processes, mathematics gains meaning, interest, and utility.





Secondary School Mathematics

★Problem Solving ★Computer Utilization ★Applications

FATHER STANLEY BEZUSZKA, WILBERT REIMER, and JIM WILSON will be the trio to head up this strand. This summer the secondary teachers will have the rare opportunity to be involved in an outstanding program that integrates problem solving, computer utilizations in secondary schools mathematics programs, and applications.

This is the second year that Father STANLEY BEZUSZKA will be with us. The teachers in the Festival of Mathematics last year encouraged us to have Father Bezuszka return to the Festival for another session. Stanley Bezuszka is the Director of the Boston College Mathematics Project.

He is well known as a mathematics conference speaker and author. Under his direction, the Boston College Mathematics Project has made significant contributions to the problem solving literature for use with secondary students. His sparkling wit, enthusiasm for problem solving, creativity expressed in the many original problem solving explorations he has authored, and his understanding of students will make this a memorable experience.

WILBERT REIMER is a member of the Fresno Pacific College mathematics faculty and a former student of Dr. George Polya of Stanford University. Mr. Reimer joins the faculty of the Festival of Mathematics for the first time this summer and brings to it a rich background in problem solving and applications.

JIM WILSON, Mathematics-Science Specialist for the Tulare City School District, is blazing new trails with the computer in the secondary mathematics classroom. Jim will be providing the teachers with approaches to his new publication involving classical mathematics problems that best "fit" the computer. Jim will also provide teachers with innovative ideas involving the Monte Carlo methods of computing area, the Dolton Board, Random Walks, and other probability and statistic problems as they lend themselves to the utilization of the computer in the mathematics classroom. Jim has developed many strategies for the secondary teacher to enrich any secondary mathematics program with the computer.

Teachers registering for secondary mathematics need to select one strand under the leadership of Wilbert Reimer or Stanley Bezuszka. Participants will actively engage in problem solving and a thorough study of problem solving strategies. One session each day will be devoted to computer applications in which Jim Wilson will coordinate the use of computers for solving problems posed by Reimer and Bezuszka. A special feature of each day will be the presentation of special topics during general sessions by Wilbert Reimer, Stanley Bezuszka, Arthur Wiebe and Jim Wilson.

1987 FESTIVAL OF MATHEMATICS PRE-REGISTRATION

ALL information requested below must be supplied before this pre-registration can be accepted and processed. Full registration and housing information will be mailed upon such acceptance.

Name ______________________________ Soc. Sec. No. ______________

Street ______________________________ City ______________

State ______________ Zip ______________ Home Phone (______) ______________

School District ______________________________

School ______________________________ School Phone (______) ______________

Please enroll me in the following grade strand:

☐ Kindergarten ☐ Third ☐ Seventh-Eighth-Ninth Secondary School Mathematics I plan to register for:

☐ First ☐ Fourth-Fifth ☐ Stanley Bezuszka **☐ Graduate Credit**

☐ Second ☐ Fifth-Sixth ☐ Wilbert Reimer **☐ In-Service Credit**

Do you wish information regarding On-Campus Housing? ☐ Yes ☐ No **☐ No Credit**

Mail to: *Larry Ecklund, Festival of Mathematics, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702*

For Office Use Only

Date Received: ______________ Processed by: ______________

Copy sent to: ☐ Registrar ☐ In-Service ☐ Business Office ☐ Housing

IMPORTANT THINGS COME IN TINY PACKAGES

I. Topic Area

Preparing a wet mount slide of onion cells to observe, study and identify major plant cell structures.

II. Introductory Statement

Upon observing onion cells, the student will be able to formulate the concept that the shape of a cell is related to its job.

III. Math Skills / Science Processes

Math Skills	Science Processes
a. Measuring	a. Recording data
b. Averaging	b. Observing and describing
c. Ratio	c. Applying and generalizing
d. Geometric shape	d. Identifying

IV. Materials

Whole white onion	Single edge razor blade
Microscope	Dropper bottle with medicine dropper
Microscope slide	Forceps (tweezers)
Cover slip	
Iodine solution	

V. Key Question

How is the shape of the plant cell related to its job?

VI. Background Information

The body of most plants is made up of roots, stems, and leaves. The life activities of a cell take place within the cytoplasm. Although cells vary in size and shape, most have similar intracellular organization and most all activities are somewhat similar. Cells really operate on two main tracks-first is the physical and chemical breakdown of essential raw materials to supply energy. The second is the process by which materials are assimilated into living protoplasm. The sum of these essential processes is termed metabolism. During the metabolic process, many complex biochemical events take place within the cell.

The **nucleus** is the most prominent feature of the cell. The nucleus is the center of control and regulates all the cell processes. It is within the nucleus of the cell that the controlling molecule of DNA is found. DNA is responsible for the passing on of features from one generation to another.

Some of the more obvious and important structures of the plant cell are the **cell wall** (support and protection), **cell membrane** (allows dissolved materials to enter and leave the cell), **vacuole** (storage for food and waste), **cytoplasm** (where other important cell structures are found) and **chloroplasts** (green colored bodies which contain chlorophyll which the plant uses to make food).

VII. Management

This activity should take two periods. It is suggested that the teacher review the process for preparing a wet mount slide. Also make sure that onions are cut in half and soaked in water overnight, this makes it easier to separate the onion's membrane (margarine tubs are good). Have single edged razor blades, tweezers, eyedropper, water and iodine available for the students.

When the students are ready to stain the onion cells, have them do this at special locations where newspaper is located. (Use stain on the newspapers. Iodine staines are hard to remove.) Pass out drawings of onion cells to the students with the cell wall, cell membrane, cytoplasm, and nucleus labeled, and their cell functions listed.

VIII. Procedure

Preparing the onion slide:

1. Clean slide and cover slip.
2. Cut a small slice from half of the onion.
3. Now carefully pull the slice apart.
4. Using the tweezers, pull off a very thin piece of membrane. (skin)
5. Place the skin in the center of your slide, so it is flat, try to keep it from folding.
6. Add a drop of water to the onion skin.
7. Cover with a cover slip.
8. Press the cover slip down carefully to remove the air bubbles.
9. Place the slide on the stage of the microscope, turn to low power, adjust the focus so the onion slice is clear and draw 4 or 5 cells as you see them. Label the cell wall.
10. Move to high power and repeat step 9. Label the cell membranes, nucleus and cytoplasm.

IX. Discussion

Staining the onion cells:

1. What is the general shape of the onion cells?
2. Add 1 or 2 drops of iodine to the slide.
3. Lower the cover slip and examine the cells on high power.
4. Iodine stains the cells to let you see parts that you couldn't see before.
5. Now label the cell wall, cell membrane, cytoplasm and nucleus on your drawing.
6. What is the general shape of the onion cells?
7. Why are there many cells close together?
8. Is the membrane (skin) of the onion composed of one cell, or many cells?

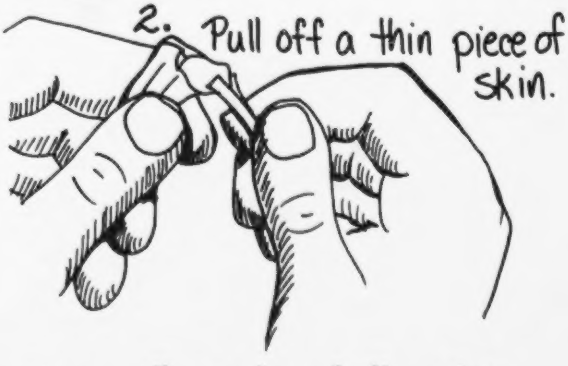
(continued on Page 32)

Name ______________________

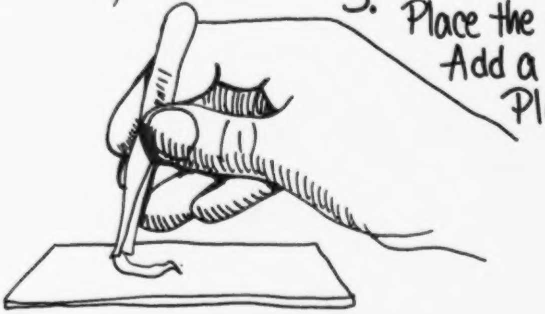
Important Things Come In Small Packages

1. Pull the onion slice apart.

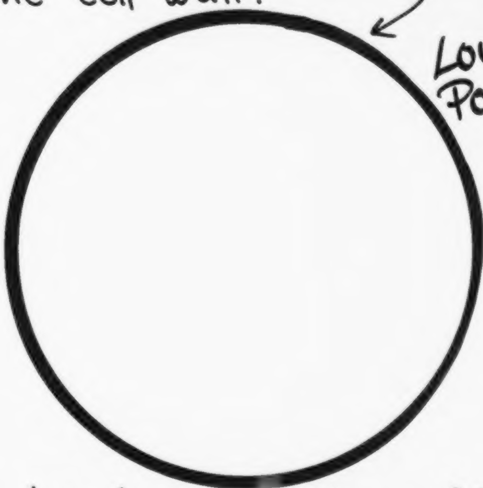
2. Pull off a thin piece of skin.



3. Place the onion slice on the center of the slide. Add a drop of water and then the cover slip. Place on the microscope stage.

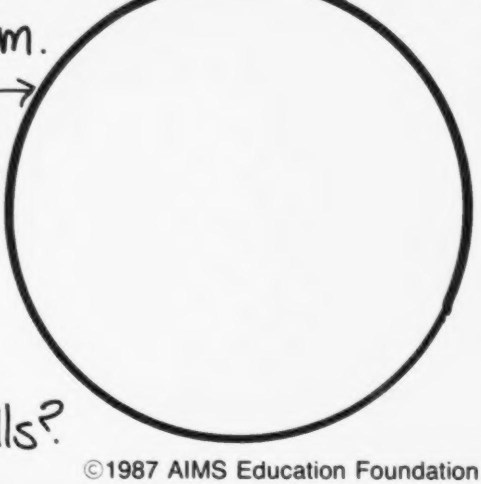


4. Observe the onion slice under low power. Draw a few cells and label the cell wall.



Low Power

5. Switch to high power. Draw and label the cell membrane, nucleus, and cytoplasm.



High Power

6. What is the general shape of the cells?

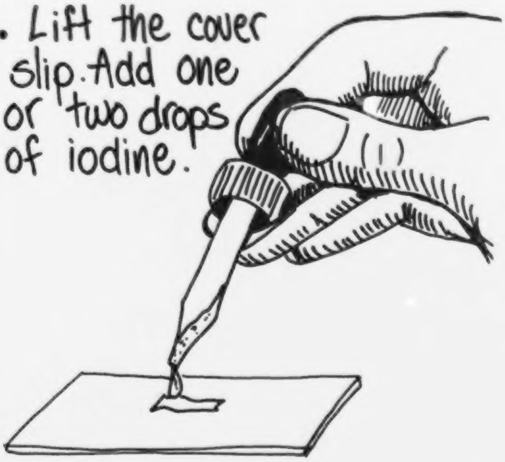
7. Is the skin composed of one or many cells?

______________________ Name

Important Things Come In Small Packages

page 2.

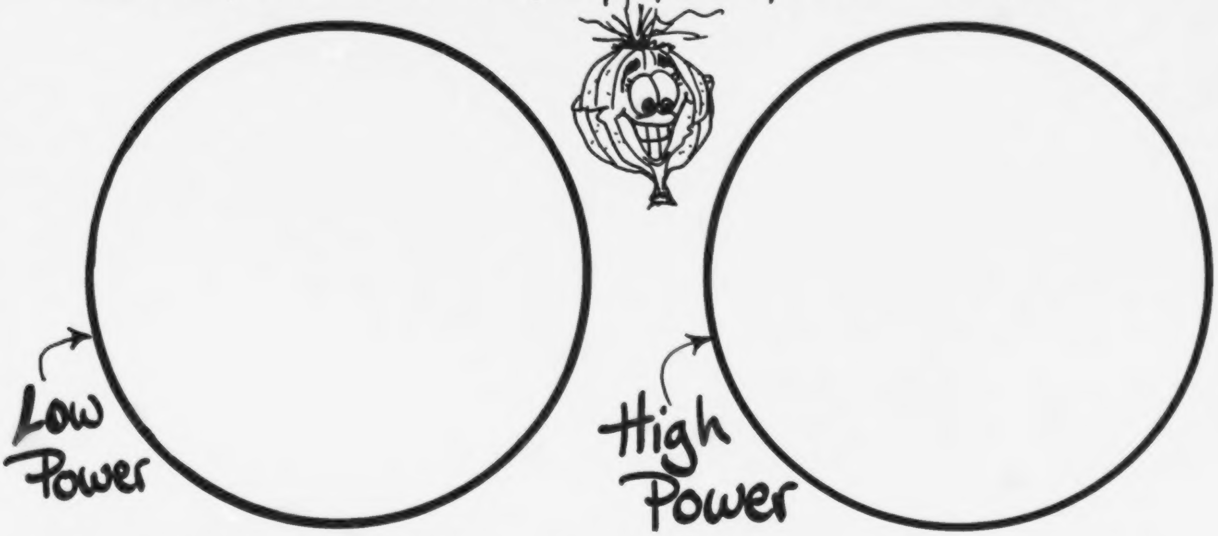
1. Lift the cover slip. Add one or two drops of iodine.



2. Add the cover slip.

3. Why did you add iodine to the cells?

4. Draw the cells under low power and high power. Label the cell wall, cell membrane, cytoplasm, and nucleus.



5. Describe the general shape of the cells. Why do you think they have this shape?

6. How many sides does an onion cell have?

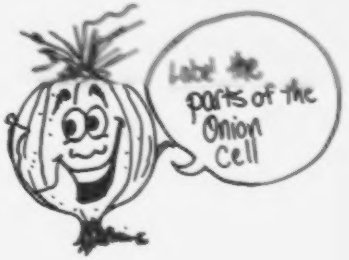
7. What geometric shape is similar to the shape of onion cells.

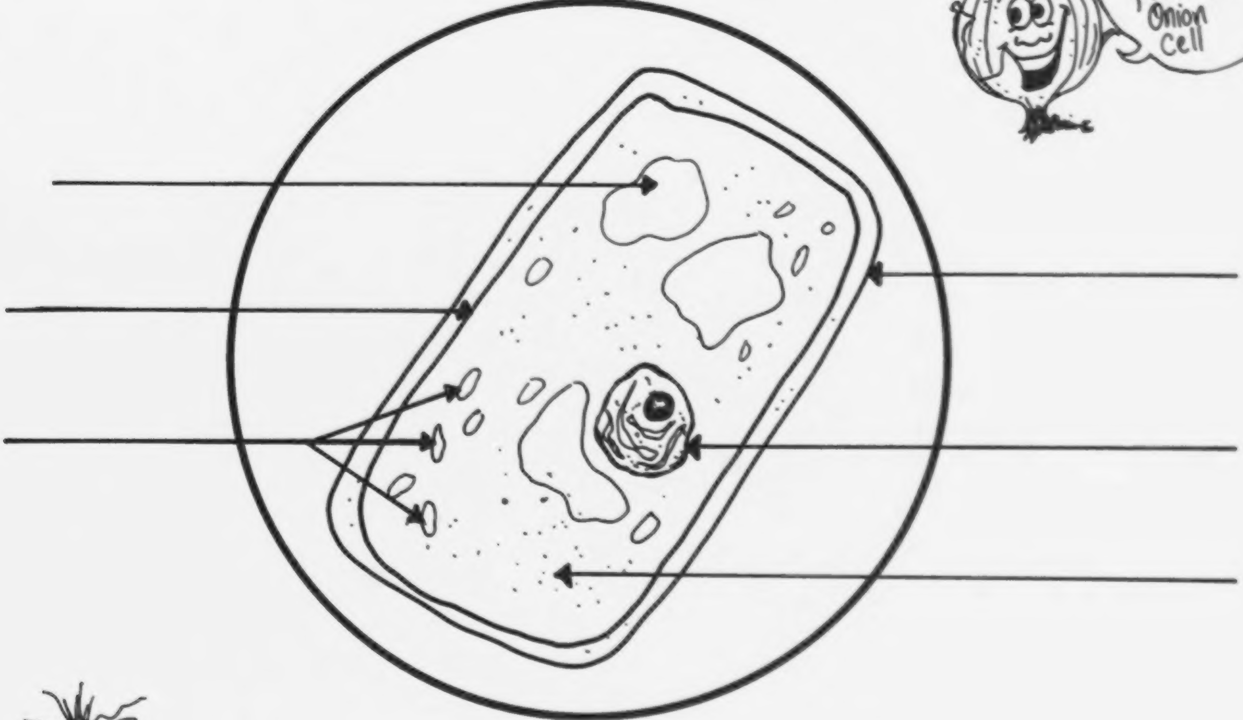
8. What jobs do you think these cells have?

9. Compare the number of cells observed in each field of view. Express as a ratio. (Ex. Low power = 6, High power = 2)

Important Things Come In Small Packages

Onion Cell Parts


Label the parts of the Onion Cell



Onion Cell Functions

Cell Wall: ______________________________

Cell Membrane: ______________________________

Nucleus: ______________________________

Cytoplasm: ______________________________

Vacuole: ______________________________

Chloroplasts: ______________________________

EGGS-CITEMENT BY THE DOZEN

I. Topic Area

Biological Science - Animals

II. Introductory Statement

The students will observe, measure, and describe properties of a variety of eggs.

III. Math Skills	**Science Processes**
a. Measuring	a. Observing
b. Estimating	b. Comparing
c. Averaging	c. Recording data
d. Computations	d. Interpreting data

IV. Materials

Eggs (AA, A, and B Grades)
String
Paper towels
Old newspapers
500 ml graduated cylinders or pint jars
Water
Waterproof felt-tip pens
Food coloring

V. Key Question

Are all eggs created equal?

VI. Background Information

See "Egg Facts"

VII. Management Suggestions

Divide the class so that three dozen eggs will be divided among the students. Each dozen will be a different grade of eggs.

VIII. Procedure

1. Describe the color, shape and texture of your egg and record what you discover.
2. Spread newspaper on the floor and roll the egg away from you. Record what you observe about the egg as it rolls (doesn't travel in a straight line). Next, spin the egg and describe what happens as it spins (spins like a top).
3. With a waterproof felt-tip pen, mark a "T" on the tapered end of an egg. Carefully place the egg in a beaker or pint jar half full of warm water. Carefully observe the egg. Record what is observed. Does the egg float or sink?
4. Predict the measurement of your egg in two ways: horizontally around the middle of the egg and vertically around both ends of the egg. Then measure the eggs vertically and horizontally, using string and metric rulers. Record the results on the activity sheet.
5. Predict how many grams your egg weighs. Weigh your egg with a balance and record the results.
6. Predict the volume of the egg. Then carefully measure how much water is displaced when the egg is put in the water and record the results on your activity sheet.
7. Compute the density of each egg by dividing its mass by its volume. Record measurements carefully. Compare the density of each egg to its ability to float and record.
8. Crack your egg and place it in a Petri dish or a clear plastic cup. Draw and label what you see.
9. For each of the Egg Grades, record the information on the Eggsact Data sheet. Figure the cost per egg and cost per gram. Also, total the dozen eggs of each grade and figure the average of each dozen.

IX. Discussion

1. Why does the egg roll the way it does? (It has to do with the shape). Compare a raw egg to a hard boiled egg.
2. Why might this way of rolling be useful to the hen in her nest? (The hen needs to constantly rotate her eggs).
3. How are eggs alike or different in size, shape, and color? What are the ranges in weight and in centimeters?
4. If the density of water is 1, and the egg in water sinks, what does this tell you about the density of the egg? Show data that substantiates this.

From the Egg Facts, Answer the Following:

5. What is the real purpose of the egg white? (To help save the yolk from damage and it becomes the first source of nourishment for the initial two weeks of embryo development).
6. What is the real purpose of the yolk? (A source of food for the embryo).
7. In a fertilized egg, where does the baby chick develop?

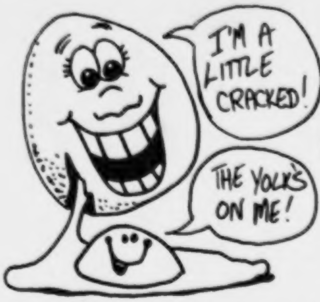
X. Extensions

Do the same activities using other kinds of eggs.

XI. Curriculum Coordinates

Art

a. Egg trees, using tree branches and egg shells for planters hanging on the branch.
b. Egg mosaics.
c. Egg mobiles using blown eggs.
d. All kinds of decorated eggs.


I'M A LITTLE CRACKED!
THE YOLK'S ON ME!

EGGS

Eggsplorer

Egg #:
Type:
Grade:

1. Eggstra Exploration:

Describe the physical properties of your egg:

Color:
Shape:
Texture:

What happens when you:....

Roll the egg?
Spin the egg?
Place the egg under water?

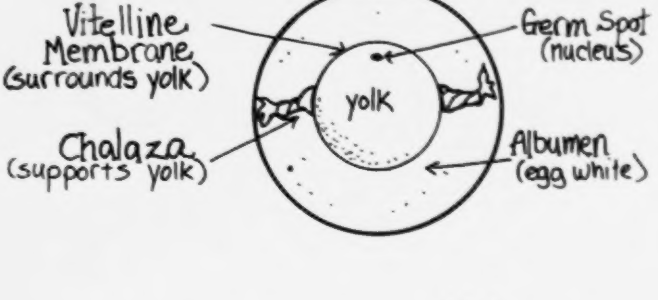
2. Eggsact Data:

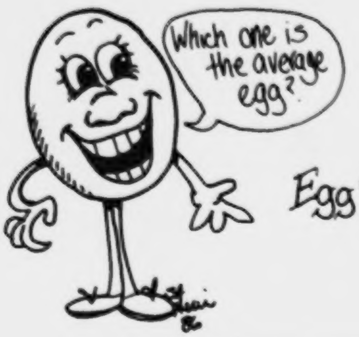
Make predictions, then gather data about your egg. Record in the chart below.

	Dimensions		Mass	Volume	Density $\frac{m}{v}=D$
	⬭	⬭			
Prediction:	cm	cm	g	ml	
Actual:	cm	cm	g	ml	

3. Get Cracking!

Crack your egg.
Place the contents into a clear cup.
Draw and label what you see.




Which one is the average egg?

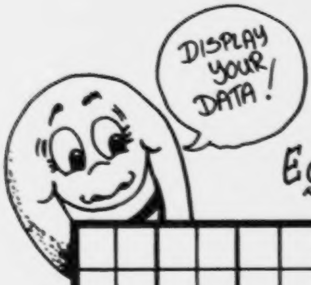
Eggsact Data

Name ______________________

Egg Type: ______________________

Price per dozen: __________
Cost per egg: __________
Cost per gram: __________

Egg #	Dimensions in cm	in cm	Mass in grams	Volume in milliliters	Density $\frac{m}{v} = D$	Float or Sink
# 1	cm	cm	g	ml		
# 2	cm	cm	g	ml		
# 3	cm	cm	g	ml		
# 4	cm	cm	g	ml		
# 5	cm	cm	g	ml		
# 6	cm	cm	g	ml		
# 7	cm	cm	g	ml		
# 8	cm	cm	g	ml		
# 9	cm	cm	g	ml		
# 10	cm	cm	g	ml		
# 11	cm	cm	g	ml		
# 12	cm	cm	g	ml		
Totals	cm	cm	g	ml		
Averages	cm	cm	g	ml		


DISPLAY YOUR DATA!

Eggsact Data

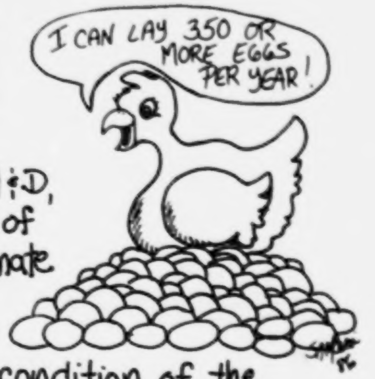
_______________ Eggsplorer

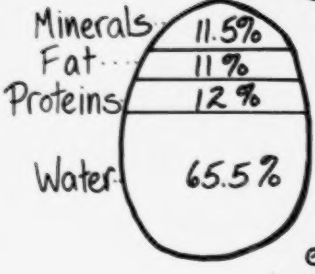
Egg Type: _______________

#1 #2 #3 #4 #5 #6 #7 #8 #9 #10 #11 #12 Average

Egg Number

EGG FACTS


I CAN LAY 350 OR MORE EGGS PER YEAR!

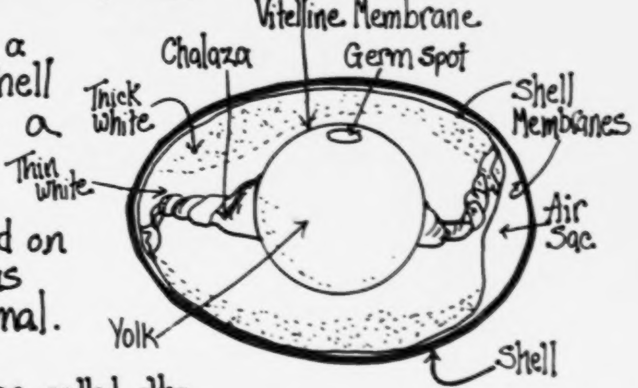


Minerals: iron, phosphorus, vitamins A & D, B vitamins, small amount of Vitamin C, calcium carbonate

The U.S.D.A. classifies consumer eggs as AA, A, and B, based on the condition of the shell, yolk, white, and air cell size.

An egg is usaally thought of as food for humans, especially at breakfast. Yet, nearly all animals develop from eggs – even humans. The main purpase of an egg is to produce young. Only certain animals such as female birds, fish, reptiles, and mast insects force the fully formed egg out of the body. A bird's egg contains food for the embryo to develop into a young bird outside the mother's body.

There are 5 main parts to a bird's egg – the germ, yolk, white, shell membranes, and shell. Each has a specific function.



Germ: This is a spot the size of a pin head on the surface of the yolk. This nucleus is what develops into a new animal.

Yolk: The yellow yolk is contained in a yolk sac called the Vitelline membrane. The yolk stays slightly above the center of the egg and floats on the albumen. After the first 2 weeks, the yolk is used as nourishment.

White: The white is called albumen and has 4 layers – thick white, thin white, inner thin white, and the chalaza. The chalaza is a thick white (twisted like a rope) which anchors the yolk to protect it. Albumen is used by the chick as nourishment before the yolk (first 2 weeks).

Shell Membranes: The membranes allow water and gas to pass through. They separate to form the air sac.

Shell: The shell is made from calcium carbonate. It protects the young bird and also acts as a source of calcium for bones.

RUBBER EGGS

I. Topic Area

Biological Sciences - Animals

II. Introductory Statement

Using decalcified eggs, the students will study the process of osmosis.

III.

Math Skills	Science Processes
a. Mass	a. Prediction
b. Circumference	b. Observation
	c. Controlling variables
	d. Interpreting data
	e. Applying and generalizing

IV. Materials

Decalcified eggs
Metric tape
Corn syrup
Beakers or small jars
Paper towels
Balance
Water

V. Key Question

What will happen to the size of a "rubber egg" soaked in water or in corn syrup?

VI. Background Information

See "Egg Facts"

Definition of osmosis: The passing of a liquid through a semi-permeable membrane from an area of greater concentration to an area of lesser concentration.

Generally speaking, the rubber egg placed in water will increase in size and weight. The eggs in corn syrup will shrink. This phenomena is due to the fact that the water molecules in the glass of water try to create a "balance" thereby passing through the egg membrane to equalize their number inside and outside the egg. The egg in corn syrup "shrinks" because the water molecules inside the egg are trying to adjust by passing outside the membrane to the corn syrup where there is a lesser concentration.

VII. Management Suggestions

1. Beforehand (about two days) put raw eggs to soak in vinegar. Leave them in the vinegar for about two days. This will take the calcium out of the shell.
2. Divide the class into groups of four students.
3. Each group will have two decalcified eggs.
4. Warn them that they must be careful with the eggs. Even though the membranes are tough and flexible, they do break.

VIII. Procedure

1. Each group will have two decalcified eggs and a beaker (jar) of water and a beaker (jar) of corn syrup.
2. Open a few soft eggs and a few hard shelled eggs and compare them to let the students see that the inside of the egg is still the same.
3. Lightly blot one of the eggs and roll it along the chalkboard to show that water is leaving the egg by means of osmosis.
4. Each group selects two "rubber" eggs of about equal size. Estimate how much each of them weighs; then weigh them and record their weights. Measure and record the circumference of each.
5. Carefully place one of the eggs in a jar of water and the other egg in a jar of corn syrup. Predict what might happen to the size of each egg (weight and circumference).
6. The eggs will stay in the liquids for 30 minutes. The students will take turns removing the eggs from the liquids at 10 minute intervals.
7. When the eggs are taken out of the liquids they are carefully blotted, weighed, and their circumference is measured and recorded.
8. Display and discuss data from all of the groups showing weight changes recorded. The eggs in water will gain weight and dimension while the eggs in the corn syrup will shrink.

IX. Discussion

1. What is the process called in which a liquid will pass through a membrane, but other things will not? (osmosis)
2. Why does water pass into the egg in the jar of water and out of the egg in the jar of corn syrup? (Because liquids move through membranes from areas where the concentration of molecules in water is great to areas of less concentration.
3. Why does the skin on our hand shrivel after we've taken a long bath or had our hands in water for a long time? (Because the water goes into the cells when we are in the water and when we get out of it, the water goes back into the air from our body, thus the skin shrivels until it goes back to its normal tightness.)

X. Extensions

1. Try this same activity using different kinds of fruit.
2. Try different kinds of eggs.
3. Put water soluble dye in a cup of water and carefully place a rubber egg in this colored liquid. Observe the process that takes place in the egg. After the egg has changed color take it out of the water and place it in the jar of corn syrup. Observe what happens and record your observations.

Rubber Eggs

____
Eggsplorer

1. First, soak raw eggs in vinegar for about 2 days. This will take the calcium out of the shell. You will be able to "see through" the egg's membrane. What do you notice about the eggs in vinegar? _______________

____

2. Take out 1 decalcified egg. Blot it dry. Roll it along the chalkboard, a paper towel, and your arm. What do you observe? _______________

____

3. Find 2 decalcified eggs of about the same size. Blot them dry with a paper towel. Estimate, then weigh and measure the circumference for each.

	Egg #1 ESTIMATE	Egg #1 ACTUAL	Egg #2 ESTIMATE	Egg #2 ACTUAL
Mass	g	g	g	g
Circumference	cm	cm	cm	cm

4. Place egg #1 into a jar of water and egg #2 into a jar of corn syrup. Describe your observations: _______________

5. Predict what you think will happen: _______________

6. Soak the eggs for a total of 30 minutes. Take the eggs out at 10 minute intervals to measure and weigh:

MASS

	START	10min.	20min.	30min.
Egg in Water	g	g	g	g
Egg in Syrup	g	g	g	g

CIRCUMFERENCE

	START	10min.	20min.	30min
Egg in Water	cm	cm	cm	cm
Egg in Syrup	cm	cm	cm	cm

7. Carefully analyse your results. What is your conclusion? _______________

____

____

____

____

CARD ON A SPOOL

GENERAL INFORMATION

Air has weight and density. It is the density that keeps balloons that are lighter than air high above the earth. Air shows resistance to any motion. This resistance keeps birds and airplanes up in the air, just as water resistance helps a water skier skim on the surface of the water. We do not usually notice the weight of air because it is much lighter than solids or liquids. Air pressure is caused by the weight of air from the top of the atmosphere as it presses down upon the layers of air below. Air pressure at sea level averages about 15 pounds on every square inch. This weight changes a little from day to day along with the weather. The column of air pressing down on our shoulders weighs about a ton (2,000 pounds). We don't feel this weight because we are supported by an equal pressure of air from all sides.

Air pressure can be used as a force to lift things. This can be demonstrated by using a straw in a glass of liquid. When the straw is in a glass of milk and the air in the straw is sucked out, the air pressure around the glass pushes on the surface of the milk. The milk moves to the path of least resistance which is up into the straw and into the mouth of the person sucking on the straw.

The Swiss Mathematician Daniel Bernoulli discovered that the pressure of a gas (air) decreases as the speed of the gas increases. The upper surface of an airplane wing is curved upward, and the bottom surface is almost flat. The curved design causes the air to move faster across the top of the wing than it does beneath the wing. The air pressure is therefore less above the wing than beneath it. The greater pressure from below gives the plane lift.

The "Card On A Spool" demonstrates what happens when air pressure is reduced. As the fast moving breath goes through the hole in the spool and out under the card, it causes the air under the card to move, thereby reducing the air pressure under the card. The stable air pressure above the card "pushes" the card against the spool.

MATERIALS

Cut a piece approximately 2" × 2" from an index card. Use a large wooden spool if possible. The straight pin is used to hold the card in place.

PROCEDURE

Follow procedures one through five as indicated on activity sheet.

POSSIBLE ANSWERS

1. If conducted properly, the air passing through the center hole will not force the card off the other end.
2. The air passing through the hole moves out under the card.
3. When blowing through the center hole while the head is tilted forward, the card will cling to the spool until the air flow stops.
4. The air passing through the hole and under the card reduces the air pressure beneath the card. The air pressure above the card holds it against the spool.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

An encyclopedia has excellent illustrations showing the effects of air pressure on moving objects. (See "Aerodynamics")

A simple experiment that students can do to demonstrate the Bernoulli Principle is to cut a strip of paper about 6" to 8" long and about 2" or 3" wide. Hold the paper close to the lips so it dangles downward below the chin. Blow vigorously outward above the paper. The fast moving air will reduce the air pressure above it and the stable air pressure below the paper will lift it to a horizontal position.

C.S.A. Innovative Curriculum Project/AIMS Education Foundation ©1987

Card on a Spool

Materials: wooden spool (thread)
2"x2" piece of tagboard
straight pin

Procedure:

1. Make sure to remove the paper labels from each end of the spool so that you can blow air through the center hole.
2. Stick the pin through the center of the tagboard.
3. Place the pin and paper on top of the spool (pin should be in center hole of spool to keep the card centered).
4. Tilt your head back and hold the spool to your lips. Blow vigorously for about 5 seconds up through the hole in spool. Make sure no air escapes around the hole.
5. Tilt your head forward, holding the card against the spool. Blow vigorously through the hole for at least 5 seconds. When the flow of air through the hole has begun, remove your hand from the card.

Questions:

1. Did the flow of air force the card from the spool when your head was tilted back?
2. Where did the air go that was forced through the hole?
3. Describe what happened when the air was forced through the hole while the head was tilted forward.
4. Explain the results of this experiment.

C.S.A. Innovative Curriculum Project/AIMS Education Foundation ©1987

SOLUTIONS AND COMMENTS

TRIANGULAR NUMBERS

Wilbert Reimer

The triangular numbers are one of the most important families of figurate numbers. Students should become very familiar with them because they occur often in problem solving situations.

In completing the table for the triangular numbers, students should discover that the differences in the numbers in the second column are 2, 3, 4, 5, 6, etc. (consecutive integers). This Level I discovery allows students to continue the table indefinitely.

Allow students to use trial and error to discover the Level II solution--the horizontal relationship

Eventually, some students will need a hint. Good hints push students towards the solution, yet leave something for them to discover. Offer hints one at a time--not all at once.

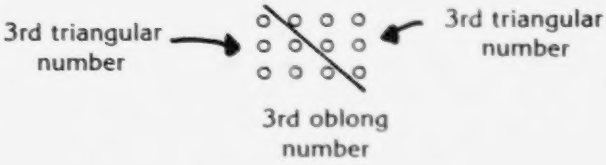
Hint 1: Suggest that students set up a "helping column," multiplying the number in the first column by a number one larger. (See table below)

Hint 2: Try dividing the numbers in the helping column by some number to obtain the numbers in the second column.

Triangular Number	Helping Column	Number of Dots
1	2	1
2	6	3
3	12	6
4	20	10
5	30	15
n	n(n+1)	n(n+1)/2

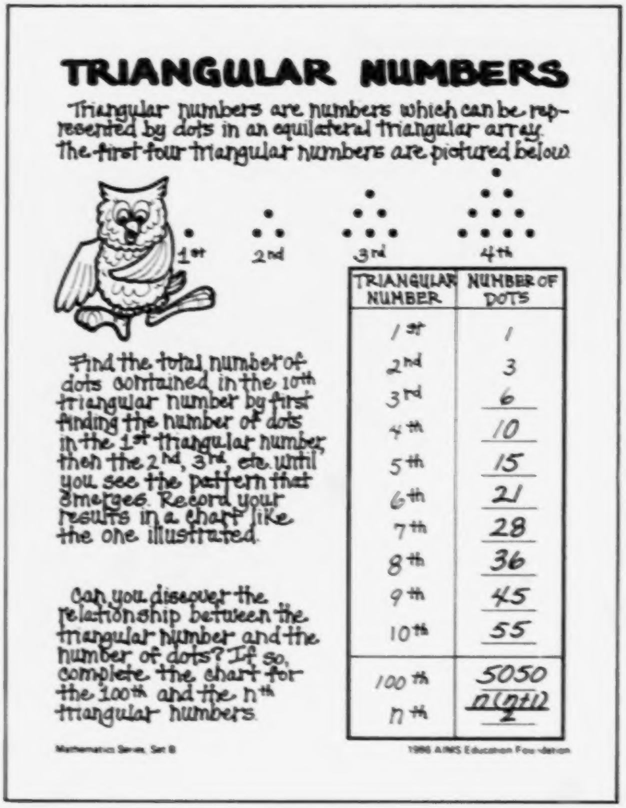
It is sometimes convenient to refer to the number of dots required to draw a triangular number as its "value." Hence, the value of the 1st triangular number is 1, the value of the 2nd triangular number is 3, the value of the 3rd triangular number is 6, etc. Our generalization says that the value of the nth triangular number is n(n+1)/2.

Note: Another way to obtain the generalization for the triangular numbers is to examine the oblong numbers in this set. Each oblong number can be separated into two identical triangular numbers. This is shown below for the 3rd oblong number.



Since the generalization for the oblong numbers is n(n+1), the generalization for the triangular numbers is n(n+1)/2.

For more information on triangular numbers, consult the appendix of the manual accompanying these posters.



TRIANGULAR NUMBERS

Triangular numbers are numbers which can be represented by dots in an equilateral triangular array. The first four triangular numbers are pictured below.

1st 2nd 3rd 4th

TRIANGULAR NUMBER	NUMBER OF DOTS
1st	1
2nd	3
3rd	6
4th	10
5th	15
6th	21
7th	28
8th	36
9th	45
10th	55
100th	5050
nth	$\frac{n(n+1)}{2}$

Find the total number of dots contained in the 10th triangular number by first finding the number of dots in the 1st triangular number, then the 2nd, 3rd, etc. until you see the pattern that emerges. Record your results in a chart like the one illustrated.

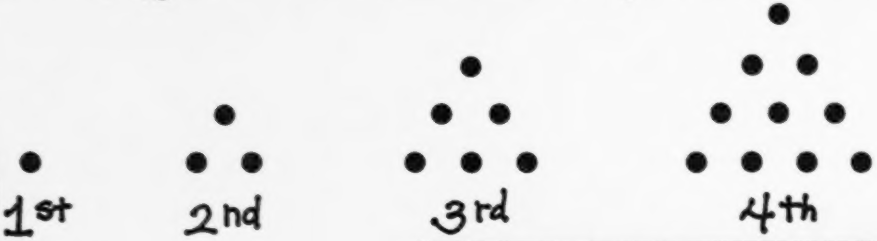
Can you discover the relationship between the triangular number and the number of dots? If so, complete the chart for the 100th and the nth triangular numbers.

Mathematics Series, Set B

1986 AIMS Education Foundation

TRIANGULAR NUMBERS

Triangular numbers are numbers which can be represented by dots in an equilateral triangular array. The first four triangular numbers are pictured below.



Find the total number of dots contained in the 10th triangular number by first finding the number of dots in the 1st triangular number, then the 2nd, 3rd, etc. until you see the pattern that emerges. Record your results in a chart like the one illustrated.

Can you discover the relationship between the triangular number and the number of dots? If so, complete the chart for the 100th and the nth triangular numbers.

TRIANGULAR NUMBER	NUMBER OF DOTS
1st	1
2nd	3
3rd	____
4th	____
5th	____
6th	____
7th	____
8th	____
9th	____
10th	____
100th	____
nth	____

COMMON CENTS

I. Topic Area

The mass of pennies and problem solving.

II. Introductory Statement

Students will investigate the question, "Do all pennies have approximately the same mass?" and will use the results for problem solving activities.

III.

Math Skills	Science Processes
a. Measuring mass	a. Classifying
b. Finding averages	b. Massing
c. Building a table	c. Organizing data
d. Using simultaneous equations (optional)	d. Drawing conclusions
e. Problem solving	e. Applying results
f. Rounding	

IV. Materials

Scales and masses

At least ten pennies minted prior to 1982 and 10 pennies minted after 1982.

V. Key Question

Do all pennies have approximately the same mass?

VI. Background Information

Pennies now in circulation that were minted prior to 1982 have an approximate mass of about 3.1 grams each. Those minted after 1982 have an approximate mass of 2.6 grams each. Pennies minted in 1982 are excluded since it was a transition year in which both types of metal compostions were used. Students will make their determination and then use it for problem solving situations in which they will be given a mixture of such coins and by massing will determine how many of the sets of pennies were minted before and after 1982.

Two strategies may be used to solve the number of each that are in the set. If ten pennies are used, a table such as this could be developed using the results of 2.6 and 3.1 grams, etc.

Pre-1982 Pennies	Post-1982 Pennies	Total Mass
0	10	26 grams
1	9	26.5 grams
2	8	27 grams
3	7	27.5 grams

The difference between the two types is added each time a pre-1982 penny replaces a post-1982 penny.

The second strategy involves the use of simultaneous equations. Using x=number of pre-1982 pennies and y=number of post-1982 pennies, we have the equation $x+y=10$ if 10 pennies are used. If z is the mass of the ten pennies, we have an equation built on the respective masses: $3.1x + 2.6y = z$. From these two equations the number of each type can be computed and then checked against the actual classification.

VII. Management Suggestions

Organize students into cooperative learning groups. Encourage each group to develop several problem solving strategies and discuss each.

VIII. Procedure

1. Organize students into cooperative learning groups.
2. Supply each group with a minimum of 10 pennies of each type.
3. Provide access to scales for massing.
4. Have students determine the respective approximate average masses.
5. Have students devise and discuss problem solving strategies for determining the mixture of an unclassified set of coins.
6. Have one student in each group prepare a secret mixture and find its mass. Then let the other students determine the distribution within the mixture and test it against the actual situation.
7. Have the entire class discuss the problem solving strategies and evaluate them.

IX. Discussion

1. What problem solving strategies were developed?
2. What is the merit or advantage of each?

____
Name

COMMON CENTS

Do all pennies have approximately the same mass?

For this investigation, select one set of pennies minted before 1982 and another set of pennies minted after 1982. Find the average mass of each type.

Description	Total Number of Pennies	Total Mass	Average Mass of a Penny
Pre-1982			
Post-1982			

If you had a set of pennies some of which were minted before 1982 and some of which were minted after 1982, could you tell how many there were of each without looking at the minting dates? If you have a plan, describe it: ____________________

____

____

____

Now have a friend give you such a mixed set and see if you can determine how many there are of each type. Then check your answer. Please report the results below.

My friend gave me a set of ____ pennies. I estimated that ______ were minted before 1982 and ______ were minted after 1982. When I classified them by minting dates, I found that ______ were minted before 1982 and ____ were minted after 1982. My per cent of error was ______ %.

★ ★ ★ ★ 1987 Project AIMS ★ ★ ★ ★

Workshop Pre-Registration

1987 Project AIMS Workshops will be offered in the locations and at the times shown on the pre-registration form below. Pre-registrations are required for all workshops together with a $50 deposit or district purchase order.

All pre-registrations are to be submitted to the AIMS Education Foundation, P. O. Box 7766, Fresno, California 93747. Enrollment in each section at each site is limited to facilitate the hands-on experiences of participants. Pre-registrations to date are heavy and teachers intending to participate should pre-register as early as possible to avoid disappointment.

In each instance, host schools are reserving up to sixty percent of the spaces for teachers from within the district and priority is given to these teachers. However, in all cases, teachers from other districts are welcome and invited to attend, subject to space availability.

The basic off-campus workshop fee is $160 and includes about $40 worth of materials, including the choice of any three Project AIMS publications. The basic fee does not include college credit. Two semester units of in-service credit is available for an additional $48, making the total fee $208.

The $50 deposit is refundable only if two conditions are met: the request is made at least 45 days before the workshop begins and there is a replacement on the waiting list. Based on past experience and the rate of pre-registrations, we anticipate waiting lists at all workshops.

Schools are encouraged to examine the option of providing teacher support through the use of PL 98-377 or similar funds. PL 98-377 is the federally funded program to provide faculty support to improve mathematics and science education. The funds are disbursed through the State Department of Education.

Pre-registrants will be notified of their acceptance within five days of receipt of the pre-registration form.

★ ★

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name: ______________________ Social Security No.: ______________

Street: ______________________ City: ______________

State: ______________ Zip: ________ Home Phone: (____) ______________

School District: ______________________________________

School: ______________ Grade Level: ________ School Phone: (____) ______________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

☐ Fairfield-Suisun Unified School District, June 22-26
☐ Edmonds (Washington) School District, June 22-26
☐ San Jose Unified School District, June 22-26
☐ Ventura Unified School District, July 13-17
☐ Placentia Unified School District, July 13-17
☐ Hesperia School District, August 10-14
☐ Mother Lode Union School District, July 20-24
☐ Sacramento, July 27-31
☐ Poway Unified School District, August 10-14
☐ El Monte City School District, August 17-21
☐ Azusa Unified School District, August 24-28
☐ Goleta Union School District, dates to be announced

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

Invitation for Writing Team Applications

Four new writing teams will be formed this Spring to begin a one-year program in which AIMS activities in four topic areas will be developed. Members selected for these teams will meet 16-20 times during the 1987-88 academic year at Fresno Pacific College. Participants can earn eight semester units of graduate credit and will receive half-tuition scholarships from the AIMS Education Foundation. An organizational and planning meeting will be held in May, 1987.

One team will concentrate on the development of activities related to water properties, uses, and conservation. This is a cooperative effort of the AIMS Education Foundation and the California State Water Resources Board. Excellent preparatory work has been done by Gilbert Yee, Harold Silvani, and others as a foundation for this writing project. The published work will be part of the AIMS series of integrated math/science activities and will be used extensively by the State Water Resources Board in their educational program. Teachers in grades three through nine are eligible to apply.

A second team will develop activities dealing with simple machines utilizing the LEGO Technic sets which contain percisely engineered gears, pulleys, levers, motors, etc. The effort has the full support and cooperation of the LEGO Educational Department. Teachers with knowledge of simple machines as taught in standard physics texts and/or experience in teaching this topic are encouraged to apply.

The third team will focus on the development of activities in color and light, building on some preliminary work that has already been completed. Teachers in grades 4-9 are eligible for this team.

The fourth team will develop additional integrated activities for K-2. There is a strong demand for additional AIMS materials at these grade levels and this effort is in response to that demend. Teachers in K-2 are invited to apply.

If you are interested in participating in one of these teams, send to the AIMS Education Foundation for the application form.

AIMS Education Foundation Adds Staff

The AIMS Education Foundation has added two part-time staff members to serve its expanding program.

James Broome has been appointed assistant office manager to Sheryl Bishop and will assist in matters relating to Newsletter subscriptions, AIMS orders, and data processing. In June, he will assume a full-time position assisting with the registrations and operations of the AIMS off-campus workshops.

D. Scott Clevenger has been appointed to a part-time research position. His assignment is to research topics which will be developed into AIMS investigations by future writing teams. Scott has an excellent background in the biological and physical sciences, mathematics, and computer education. One of the first tasks will be to prepare for the writing of an AIMS book dealing with water properties that is being produced in cooperation with the California State Water Resources Board.

Important Things, continued...

9. Why is it easier to see the onion cells after they are stained with iodine?
10. All plant cells have cell walls. What is the job of the cell wall?
11. Can you see a line on the inside of the cell walls? What is the structure's name? What is its job?
12. Each cell has a control center. What is the control center called? Where is it located?
13. Count the number of cells that are seen in the field of view under low power magnification and also high power magnification. Compare the number of cells observed in each field of view. Express as a ratio. (Ex. low power 6-high power 2.)
14. How are the onion cells related to their shape? How many sides does an onion cell have? What geometric shapes may be similar to the onion cell's shapes. (Ex. polygons.)
15. Why are onion cells more like squares and rectangles than ovals? (Ex. fit together better for protection.)

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Please circulate to all teachers

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation
A Non-Profit Tax-Exempt Foundation

Volume 1, Number 8 March, 1987

AIMS Education Foundation Accepting Applications to Host Summer, 1988 Workshops

The AIMS Education Foundation is prepared to accept applications to host one-week AIMS Workshops in the summer of 1988. The workshop schedule for the summer of 1987 has been filled and no more applications for this summer are being accepted.

Interested school districts, regional consortia, and other educational organizations are invited to submit applications to host such AIMS workshops. These will be given priority on the basis of date of submission. It is anticipated that thirty locations throughout the nation will be selected. Some applications are already being received.

Each workshop will be of five days duration and includes 30 hours of instruction. The emphasis will be on the "hands-on" integrated mathematics/science activities drawn from the extensive resources of the AIMS program. Included will be activities that are constantly being developed by the current writing teams.

Experienced workshop leaders drawn from the AIMS National Leadership Network will serve as the instructors.

Host schools agree to provide appropriate classroom space and related services at no cost to the Foundation. Classrooms should be equipped with tables and chairs to accommodate up to 40 teachers in an activity mode. Host organizations also agree to cooperate in promoting participation.

The AIMS Education Foundation will pay for all instructional costs, the hosting and travel of instructors, materials, and workshop supplies. As needed, the Foundation will loan the necessary science equipment for conducting the workshops.

The minimum enrollment per workshop **section** is 30 teachers and the maximum is 40. Therefore, the minimum enrollment for these three-section workshops is 90 and the maximum is 120.

Pre-registrations must be received at least two months prior to the date of the workshops and will be used to determine that the minimum has been reached and the enrollment is within the maximum.

All workshops will be three section workshops in which instruction is focused at three grade level spans such as K-2, 3-5, and 6-9. The precise span will be determined in each case by the pre-registration distribution.

Participants will receive 30 hours of instruction, primarily hands-on; a thorough introduction to the Model of Mathematics and Science, numerous handouts of AIMS lessons with duplication rights; and the choice of three AIMS publications. The value of these lesson materials exceeds $50.00.

The basic cost without college credit is $170. Two semester units of college credit from Fresno Pacific College is available for an additional $50 tuition fee; or, the local sponsoring agency may arrange for college credit through a local college or university. College credit is optional. Fresno Pacific College is fully accredited by the Western Association of Schools and Colleges.

The application form is on page 31.

AIMS Workshops
Scheduled for Illinois, Pennsylvania and Michigan

Judith Hillen and Arthur Wiebe, AIMS Program Directors, will be making a series of AIMS presentations to teachers in Illinois, Michigan, and Pennsylvania.

Judith Hillen will be at Loyola University in Chicago, Illinois to conduct an all-day AIMS workshop on April 29. Diane Shiller of Loyola is the coordinator. Attendance is limited to 60 selected master teachers.

During the week of March 9, Arthur Wiebe presented a series of AIMS workshops in Michigan. The first three workshops, March 9-11, served teachers in the Kalamazoo region through the Instructional Center at the Kalamozoo Valley Intermediate School District. Ms. Elizabeth Christensen is the coordinator of the center. On March 12 the AIMS workshop for teachers in the Port Huron area was presented under an arangement through Clarence Brock. This was followed with a similar workshop for Sandusky teachers on March 13. Beginning in the second week in October, six AIMS workshops will be presented in Michigan, including Grand Rapids and Flint. The full details are still being worked out and the final program will be announced in the August issue of the Newsletter.

In November, it is Pennsylvania's turn. On November 5, Hillen and Wiebe will be conducting separate workshops in the Pittsburg region. On November 6 and 7 they will be attending the National Science Teachers Association Area Convention in Pittsburg and making presentations as well as staffing an information booth. On November 9 each will conduct workshops in the Lancaster region. Details will be announced as soon as they are finalized.

Duplication Privileges and Restrictions

The financial resources for the continued research, development, and dissemination of Project AIMS materials are derived solely from the sale of books, posters, and AIMS Newsletter.

It is, therefore, of utmost importance that all educators and educational agencies comply with the privileges and applicable restrictions for duplication.

It is the intention of the AIMS Education Foundation to make its publications available at reasonable cost. Therefore, a school is granted the right to make 200 copies of any of the materials in any of the publications that have been purchased for use by teachers at that school site. If more than 200 copies are to be made a supplementary agreement must be negotiated with the AIMS Education Foundation.

Workshop leaders may make up to 200 copies of any of the materials in the same manner as schools. However, only student pages may be so duplicated. Copies of the teacher's manual may be made for a maximum of one-fourth of the investigations used in a workshop. Teachers receiving copies from workshop leaders may duplicate no more that 35 copies of student pages or enough to use the lessons one time with their class. Any further duplication without the purchase of the materials is strictly forbidden.

All educators conducting AIMS workshops are expected to explain the Model of Mathematics and consistently refer to it as the activities are presented since this Model is the basis upon which the AIMS program rests and its understanding is necessary to achieve the primary objective of AIMS.

If an educational agency publishes a newsletter or other form of publication for distribution to multiple sites, no more than 200 copies may be made of any of the materials without permission from the AIMS Education Foundation and the payment of an additional fee. Further, such multiple-site newsletters may duplicate no more than one science activity and one mathematics activity from each issue of the AIMS Newsletter.

At any time that AIMS materials are duplicated the AIMS Education Foundation copyright must appear. In the case of workshops and newsletters, information regarding the availability of AIMS publications and the fact that they may be ordered from the AIMS Education Foundation must be noted.

Any violation of these conditions that result in the evasion of purchases through disregard of these restirctions is detrimental to the program of the Foundation and is strictly prohibited.

Special Newsletter Subscription Renewal Rate Offered Charter Subscribers

Charter subscribers may renew their subscription to the AIMS Newsletter for 1987-88 at a special $20.00 rate even though the annual subscription rate has been increased to $22.50. **Subscription renewals must be received by June 15, 1987 to be eligible for this special rate.**

Current readers are aware of the fact that the content of instructional materials which can be duplicated for classroom use has increased during the first year of publication. This increase in the subscription rate reflects the added cost of this expansion.

Initially, the Newsletter featured three new AIMS investigations. Some of the issues in the current year already contain four new AIMS activities. All issues in the 1987-88 subscription year will have four AIMS investigations selected from the new materials now being field-tested by the writing teams. These will reflect the ten new topic areas currently under development.

The science poster will continue to be included in each issue.

A new feature introduced in the February, 1987 issue which will become standard in 1987-88 is a second set of mathematics posters in a new series. This series will provide another set of excellent problem solving activities involving higher order thinking skills. A thorough analysis of problem-solving approaches appropriate to each problem situation in this series will be included. This analysis will serve as an aid to

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $20.00 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May making available the entire content of vital articles and the thirty or more new AIMS investigations and twenty science and mathematics posters. Second-class postage paid at Fresno, California. Address all correspondence to **AIMS Newsletter**, P.O. Box 7766, Fresno, California 93747 Volume 1, No. 8.

AIMS EDUCATION FOUNDATION

PRESIDENT . . . . Arthur Wiebe, Ed.D.
VICE-PRESIDENT . . . . Wilbert Reimer
SECRETARY . . . . Lawrence Ecklund
TREASURER . . . . Jon Hillen
ACCOUNTANT . . . . Robert J. Dwyer
STAFF ARTIST . . . . Sheryl Mercier

classroom teachers who wish to enhance their own knowledge of problem solving and in helping students acquire an inventory of problem-solving skills. Authored by Dr. Arthur Wiebe, it joins the series authored by Wilbert Reimer. Both Wiebe and Reimer studied extensively under Dr. George Polya at Stanford University and his influence is reflected in these problems.

The ten issues will contain forty new AIMS investigations, ten science posters and twenty problem-solving challenges, plus numerous articles dealing with the teaching of "hands-on" science, evaluating higher order thinking skills and student progress in mastering process skills, and developments in the AIMS program.

Beginning in May, 1987, the entire set of ten 1986-87 issues will be available as a packet for $22.50. This set will have a total of 35 AIMS investigations, 14 mathematics posters, 10 science posters, and numerous articles of permanent value, including a thorough discussion of the Model of Mathematics and its application in improving mathematics instruction.

New subscribers who order both the 1986-87 packet and enter a subscription for 1987-88 are offered the special combination price of $40.00, which represents a saving of $5.00 over separate purchases.

Since duplication rights for one school site are granted for all materials published in the Newsletter, it is highly cost effective for a school to enter a subscription for the use of all of its teachers.

The publishers are pleased to report that the number of subscribers during this first year reached fifty per cent of the level needed to make the Newsletter entirely self-supporting. This is in line with the initial projection that it would take two years to reach this goal. We ask our readers to share the information about this Newsletter with other teachers so that we can achieve self-sufficiency at the earliest possible time. This will permit the Foundation to preserve its limited resources for continued research and development.

The publishers appreciate the highly favorable reception accorded the Newsletter in its pilot year. We pledge to continue to bring to our readers content that is immediately useful for students and background information and articles that are helpful for teachers.

You are invited to be a charter subscriber!

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Each of the ten 1986-7 issues includes the following:

Three or more new AIMS investigations one at each of these grade levels: K-2, 3-5, and 5-9; one 8.5 x 11 inch science poster and one mathematics poster for duplication; information about AIMS activities including workshops to be conducted by members of the AIMS National Leadership Network; feature articles such as the five-part article on problem solving by Wilbert Reimer; a description of how a school, school district, and state is implementing AIMS in a systemmatic manner; information about course offerings including the summer program; a thorough preview of all new AIMS and SETUP publications; information about all products currently available; progress reports on such programs as the National Leadership in Math and Science program; information about conferences where AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc. The subscription will be on an annual basis only so that a subscription entered at any time will receive the 10 issues for that year beginning with the August issue. The reason for this arrangement is that many of the articles appearing in installments need to remain available in their entirety.

The cost is $20.00 per year. During the 1987-8 year, the number of new AIMS investigations will be four per issue and the number of mathematics posters will be increased from one to two per issue. Otherwise, the content will be similar to that of 1986-7.

Charter members ordering 1986-7 subscriptions may still receive the 10 issues beginning with the August, 1986 issue for the $20.00 subscription price. The subscription rate for 1987-8 is $22.50 for new subscribers. However, new subscribers who order both the 1986-7 packet and enter a subscription for 1987-8 are offered the combination price of $40.00, a saving of $5.00 over separate purchases.

Check One:

____ Renewal subscription for 1987-8, $20.00
____ New Subscription for 1987-8, $22.50
____ Purchase of 1986-7 packet containing all ten issues, $22.50 (available May, 1987)
____ Purchase of 1986-7 packet containing all ten issues and New 1987-8 subscription, $40.00

Subscription Information:

Name: ____________________________

Address: ____________________________
Street

____
City State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, Ca 93747

Learning the metric system is easy when students participate in the AIMS investigation entitled "Metric Olympics."

Right: How many grams of marbles can you grasp in one hand?

Lower right: How far can you toss the straw javelin, measured in centimeters?

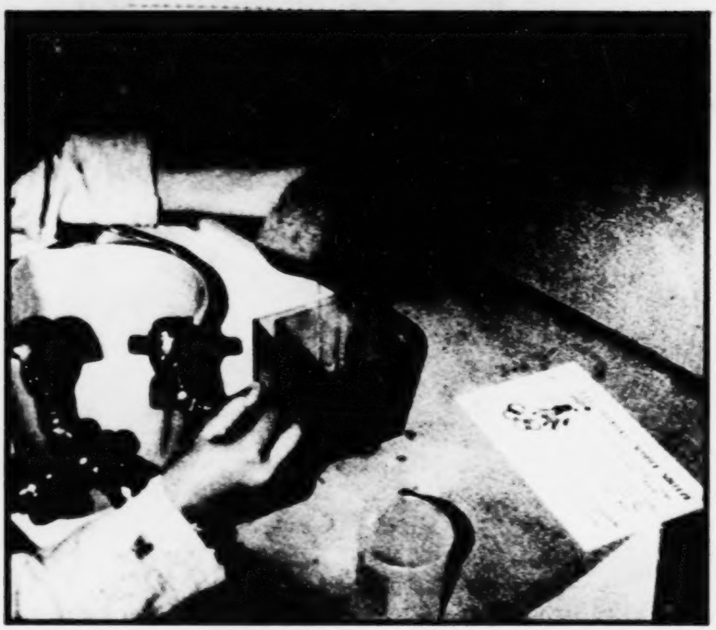
Gilroy AIMS for the TOP!

In the fall of 1985, at the invitation of Assistant Superintendent Frank Ginelli and Gilroy, California Unified's Science Textbook Committee, Judith Hillen, Director of Project AIMS presented a full day of hands-on activities from the AIMS program. This proved to be the beginning of a real commitment to excellence in science education. The nearly twenty teachers involved in that in-service shared their enthusiasm for the integrated, real world approach to math and science with other teachers in the district.

In the summer of 1986, science mentor teachers John Licursi, Carolee Maya and David Pribyl joined two other district teachers, Pam Rubio and Kathy Frazier, in participating in the two-week Science Festival offered at Fresno Pacific College. They attended sessions led by nationally recognized leaders in science education such as Vern Rockcastle, Del Alberti, Joe Abruscato, Gilbert Yee, Al Guenther and Herb Strongen. They were also an integral part of additional AIMS training in methodology, process and more "hands-on experiences."

Returning to Gilroy excited and full of ideas, the mentor teachers and the Science Committee members drafted a pilot scope and sequence for grades K-6 that included an activity guide that correlated appropriate AIMS activities with each science objective at each grade level from the California State Science Framework Addendum. Each member of the committee then shared that scope and sequence with three school sites prior to the opening of school in the fall.

The response of the teachers was overwhelmingly positive! Whole-hearted support from the site administrators at each school and the District Office, came in the form of the purchase of a complete set of Project AIMS books, two AIMS kits of science equipment, and the establishment of a fund for



consumable expenditures required for many of the lessons, at each school. The teachers and students are grateful for this kind of support and encouragement from administrators.

Gilroy Unified has demonstrated a long term commitment and support by funding four teachers, David Pribyl, John Licursi, Carolee Maya and Pam Rubio through the Trainers of Teachers Program at Fresno Pacific College which began with their participation in the Science Festival. They attend classes on Saturdays in Fresno during the school year.

During the 1986-7 school year, these trainers have provided quarterly AIMS workshops, K-3 and 4-6, after school with district credit available. The response has been so overwhelming that waiting lists had to be set up to handle the demand.

In addition to the workshops offered by the trainers, they have visited classes to conduct demonstration lessons such as "You Gotta Have Heart" and "Mini Metric Olympics" as shown in the photographs. David Pribyl shares, "AIMS's popularity in our schools is due in no small measure to the fact that it reduces rather than increases the demands on the teacher since it simultaneously teaches science and math content in the best possible way ...integrated!" Gilroy is surely AIMing for the top!

These testimonials come from Gilroy:
Students say:

"We got to learn how to estimate better."

"It's fun because we got to use a scale."

"I like the Olympics because it's different from what we do in math. It's fun also."

"That was the funnest hour of science this year."

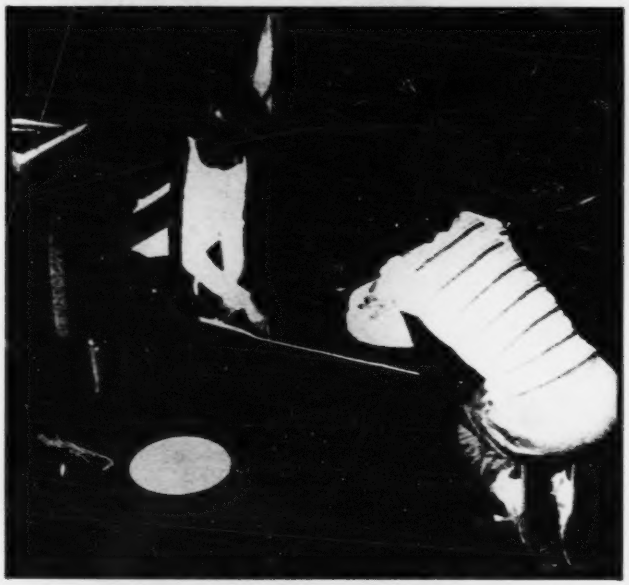
"Usually in science we just sit there and listen, but this time we got to do something."

"I didn't know it could be so easy to make a stethoscope that really works."

Upper left: How many milliliters of water can you squeeze out of the sponge with one grasp?

Above: How many square centimeters are covered by your foot?

Below: Students are measuring the distance they have tossed the paper plate discuss in centimeters.



"I especially enjoyed making the clay hearts because I got to work with my hands."

"I liked moving around the room and having fun. We didn't have to stay in our seats and I had fun learning about metrics."

"I liked the paper plate discus because I was only five off."

Teachers say:

"Not only was it fun for the students, it was fun for me!"

"I had never seen students so excited about learning science and math. They beg me for more activities like this."

The Kings County Project AIMS Consortium

By Larry Newman

Is it possible for small schools, with limited financial resources, to implement and carry out a highly effective Project AIMS staff development program?

Yes! Schools in Kings County California have shown that even with limited resources they can establish an effective Project AIMS program if they join their resources and work closely together. Schools in the county have just completed one and a half years of a very successful program that not only has provided excellent inservice training for teachers, but has provided a strong follow-up program that ensures teachers and students are really getting to the heart of Project AIMS.

The joint effort began in mid 1985 when Kings County Schools Special Projects Director Douglas W. True contacted several of his educational colleagues in area school districts regarding the implementation of Project AIMS program in their schools. True pointed out the difficulty of each school district trying to implement its own program. He suggested that if all the schools join forces, they would be able to come up with a program for all schools that would better meet the needs of each district.

Knowing well the problems of limited resources and the issue of being a prophet in your own land, representatives from several districts agreed to meet and consider the possibilities.

A planning meeting was held at the Kings County Schools Office on November 15, 1985. At that meeting the philosophy of Project AIMS was reviewed, emphasizing the fact that children learn more easily and quickly, and retain the knowledge longer, when they TOUCH the real world than when they vicariously encounter the world through textbooks alone. It was reiterated that Project AIMS helps students learn to think critically, develop a clear hypothesis, and become better problem solvers.

The decision was made that the best way to help the individual school districts would be to develop a core of Project AIMS consultant-specialists that could go to the individual school districts to train the teachers in the concepts of Project AIMS. It was found that four teachers in the county were directly involved with Project AIMS through Fresno Pacific College and were highly successful in implementing AIMS activities in their classrooms. Those four were contacted and agreed to serve as trainers for Kings County teachers. The original core of consultant specialists was Judy Harrison of Lemoore Elementary School District, Shirley Faircloth, Gina Wiens, and Wendy Roberts-Worley, all of the Central Union Elementary School District. These consultant-specialists were given training in conducting effective workshops. They proceeded to plan a presentation which was video-taped and then critiqued as a self-review.

Teachers like to experience AIMS activities themselves before trying it in their classrooms. Gina Wiens has used this activity and can help others from that experience.

It was decided that the training for teachers should be developed at three levels. Level one would last from one to two hours, involve a discussion of the elements and philosophy of Project AIMS, include an investigation, and conclude with a "debriefing" discussion.

Level two would consist of three or four sessions, include classroom demonstrations, and show the teachers various activities that they could use in their classrooms. These sessions would include hands-on instructions so the teachers could actually experience the demonstrations just as their students would experience them. The AIMS consultant-specialists were able to field teacher questions ranging from educational theory to operational problems such as "What do I do when a student fails to bring something from home needed to conduct the activity planned for the day?"

"It's fun teachng science when you get away from the textbook," says AIMS teacher, Wendy Roberts-Worley.

This level two training would be the heart of the training and would have the highest potential for a teacher to be able to fully implement a science program achieving the California Science Framework goal of teaching the science processes. To date 100 teachers in the county have received this level of training.

At level three, specific Project AIMS demonstration lessons were to be developed to match specific CAP weaknesses in science and math at the individual school districts. In addition, there would be an evaluation of level two to discover weaknesses, and there would be follow-up with individual teachers.

Ten school districts chose to join together and assign their PL 98-377 staff development funds to support the program. Those districts included were Delta View, Kit Carson, Kings River, Pioneer, Armona, Lakeside, Reef-Sunset, Lemoore Elementary, Central Union Elementary, Island, and Corcoran Unified.

Under the facilitation of Doug True and Frances Villa the Project AIMS Consortium has provided training sessions at each district. Many of the districts have had two sessions, and the Central Union School District has had three on-going, with one more planned for the near future. Patsy Johnson of Lemoore Elementary has been added to the consortium of trainers with other potential trainers being identified. New trainers are teamed with experienced presenters as the core of specialists continues to grow.

"This has been so exciting", says Wendy Roberts-Worley, an AIMS science specialists who has seen the consortium grow from an idea by Doug True into an effective, viable training tool for area teachers. "It is an exciting way to teach, and the kids really enjoy using Project AIMS. The teachers also get excited about it, and really enjoy getting away from the text to teach science. Most teachers at the elementary level don't have a strong science background, and they really appreciate the fact that Project AIMS allows them to teach a strong, fun science and math program without that strong background."

For facilitator Fran Villa, the most important part of the program is the follow-up provided by the trainers and facilitators. She feels that this is one of the strongest parts of the program. "When teachers try things they learn in workshops, they often experience difficulties, it is our goal that teachers have the proper follow-up to help them get over these problems. We try to go back to the individual teachers, talk with them, and find out what they experience. If they have a particular problem, we try to show them how to solve it. This is also a way for the trainers and facilitatiors to learn from the teachers. When we go back, we often learn things that we incorporate into future training sessons. Learning is a two-way street for us too."

After eighteen months the program is still growing. School districts are still scheduling training sessions, and teachers are still learning better ways to teach their students. Everyone agrees that by joining together, the eleven schools are far better able to provide their teachers with Project AIMS training than if they had tried to use their PL 98-377 funds individually. Truly, the Kings County Project AIMS Consortium has done all it was designed to do and even more.

The Five Ray Problem

Shown on Page is the Five-Ray Problem. The task is to use the set of numbers from 1-11 and place them into the circles so that the sum along each three-segment ray is the same.

Students improve in their problem solving skill as they accumulate an inventory of techniques from which they can draw one that is appropriate for a given situation. Our task is to expose them to numerous approaches to solving problems.

In the previous issue we discussed the solutions to the Fascinating Triangle problem. Students typically begin to explore a given microworld by using trial and error, a valuable problem solving skill. However, there comes a time when it is important to move beyond that level to logical thinking. One important technique used in that problem was to find the sum of the six numbers used and add to that the sum of the numbers used at the vertices since these must be added in twice, once along each of two legs.

While students may well begin the exploration of the new activity and the trial and error level with considerable benefit, we would hope that some would call upon their inventory of approaches and use the same type of logical reasoning referred to above. This is how we will begin.

We are using the numbers 1-11. Their sum is 66. The one in the center will be used five times and, therefore, must be included in the sum of the solution five times. Since it has already been added in once in the processing of finding the sum of 66, it must be added in another four times to find the sum of the solution.

The "sum of the solution" refers to the sum of the five sub-sums of the five rays. The sum of the solution must be a multiple of five since there are to be five equal sub-sums.

If 1 is used in the center, we must add four times 1 or 4 to 66. This totals 70. 70 is a multiple of 5 and therefore such placement of 1 appears promising. Since 70 divided by 5 is 14, the target sum for each ray would be 14.

By using 1 as the center number, the other two numbers in each must have a sum of 14-1=13. It is not difficult to see that we have five such pairs: 11+2; 10+3; 9+4; 8+5; and 7+6. We have the solution for this microworld.

Now that we have had success with 1, let's examine 2 as a candidate for the center number. First, let's obtain the solution sum that would be yielded if 2 is placed in the center: 66+2+2+2+2=74. But, 74 is not divisible by 5. Therefore, using 2 in the center will not result in a solution.

Next we apply the same test to 3. 66+3+3+3+3=78. Again, we fail to obtain a multiple of 5 and therefore 3 will not result in a solution.

Our test moves to using 4. 66+4+4+4+4=82. Clearly, the use of 4 will not be successful.

What about 5? 66+5+5+5+5=86. No luck!

This is getting discouraging! It appears that the number of solutions is very small. But, let's persist! Testing 6 we have 66+6+6+6+6=90. Aha! 90 is divisible by 5 and if divided by 5 has a quotient of 18. Since 18-6=12, the sums of the other two numbers in the rays must be 12. Looking at the numbers available after 6 is placed into the center, we have these pairs that have a sum of 12: 11+1; 10+2, 9+3; 8+4; and 7+5. Therefore, we have a second solution.

At this point we note that the center numbers of solutions are 1 and 6. Let's underline them as we list all the numbers in order:

1,2,3,4,5,6,7,8,,9,10,11.

Note that the first solution uses a number from the beginning of this sequence and that the second solution uses a number at the center. We could make several hypotheses at this point:

a. 11 would seem to be a good candidate for a solution since it is at the upper end of the sequence. Also, it is symmetrically placed with respect to 1.
b. Since the numbers between 1 and 6 did not yield a solution, it seems reasonable to hypothesize that the numbers between 6 and 11 will not yield a solution.

Since 11 appears promising, let's try it first. 66+11+11+11+11=110, a multiple of 5. Dividing 110 by 5 we obtain 22. Note that the sums of the rays in each of the previous solutions were 14 and 18 respectively. 14, 18, and 22 form a sequence where each sum is 4 greater than the previous sum. This is all very encouraging. If the sum is 22 and the center number 11 is subtracted, the difference is 11. Five such pairs exist: 10+1; 9+2; 8+3; 7+4; and 6+5. 11 in the center gives a third solution.

Returning to the intermediate numbers we test each in turn. Trying 7 we have 66+7+7+7+7=94, not a multiple of 5. No solution.

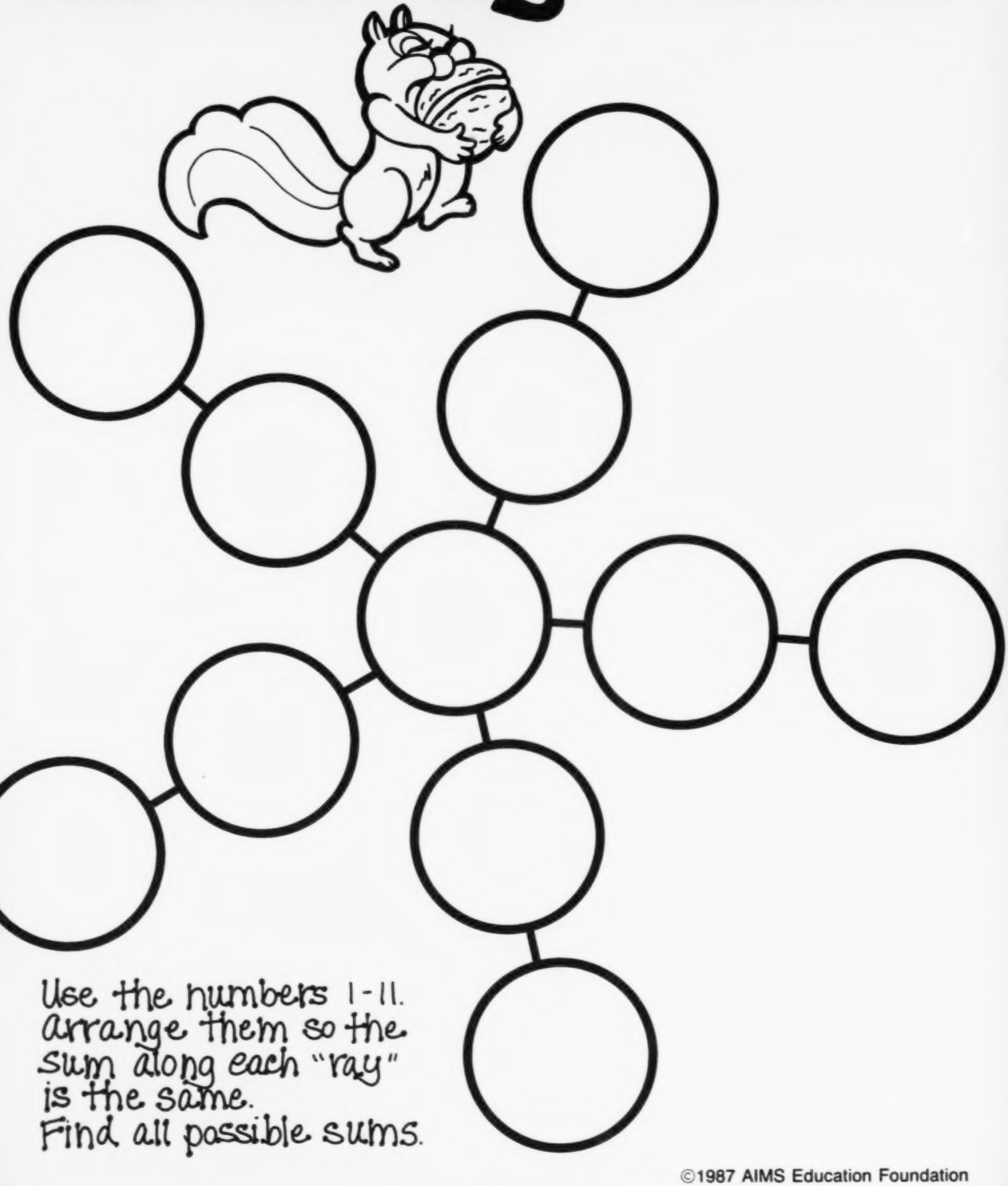
Testing 8, we have 66+8+8+8+8=98, again not a multiple of 5 and not a solution.

9 gives a sum of 102 and does not yield a solution. 10 gives a sum of 106. Not a solution.

Therefore, the only solutions are 1, 6, 11. These are the numbers at each end and the one at the center.

The trial and error approach would provide much beneficial drill in addition for students as they seek to find solutions but would soon be seen as inefficient and time-consuming . Further, the student would have to make many trials systemmatically to be sure that a given number placed in the center did not yield a solution. Logic makes the entire task much easier and our work more efficient. Further, students can be sure that they have found all of the solutions.

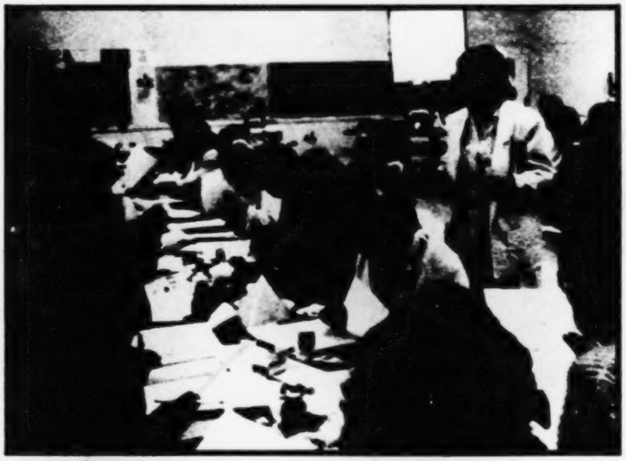
The Five Ray Problem



Use the numbers 1-11.
arrange them so the
sum along each "ray"
is the same.
Find all possible sums.

Upper left: Carloyn Little brings her enthusiasm for AIMS into every workshop. The remaining pictures show teachers in the workshop involved in making the tetrahedron kites, testing for the amount of sugar in bubble gum; studying the content of M&M bags, and generally enjoying their hands-on experience.

AIMS National Leadership Network Introduces Carolyn Little...



Nestled in a hot spot of the southern region of California is a dynamic young lady by the name of Carolyn Little. She is a science mentor teacher for Palm Springs Unified School District and teaches third grade at Lindley Elementary School. She also happens to be a very active member of the AIMS National Leadership Network team and is spreading the good news of hands-on activities that integrate math and science. She says, "I want to make science as much fun for teachers as for students. Science isn't stagnant. It shouldn't be 'open your books and do problems one to four'. You've got to get involved."

Carolyn shows her students and her fellow teachers how to get involved. Second grade students at Rancho Mirage school got involved by assessing soft drinks. Children surveyed their own soft drink preferences, constructed graphs, learned about nutrition, made their own carbonated soda (Sorda Pop from AIMS **Glide into Winter,** p. 68), and wrote letters to Coca Cola to inform the company of their research and finding. Coca Cola responded by sending two complimentary cases of cherry coke to Carolyn's class.

Carolyn also spends much of her "extra" time offering workshops to teachers. She recently spent a day with sixty teachers and teacher's aides from La Quinta and Van Buren Schools in the Desert Sands Unified School District. The cooperative spirit between Palm Springs Unified and Desert Sands Unified in sharing Carolyn Little is very encouraging.

In addition to workshops Carolyn has been giving demonstration lessons to all first through fifth grade classes on how to prepare a science project for the science fair.

Carolyn joins the Fresno Pacific College faculty team in presenting AIMS workshops as part of the 1987 Summer program. Evaluations and comments from teachers and students reaffirm Carolyn's success at making science come alive. She is a terrific addition to our leadership team. Pictures here show Carolyn and teachers in action at a typical workshop.

SOLUTIONS AND COMMENTS

BUSY INTERSECTIONS

Like many other problems in this series, this problem gives students experience in collecting data, organizing it in a table, and discovering the pattern that emerges.

This problem requires the use of Pascal's Triangle. Students should have a copy available or the Pascal Triangle Poster in Set C should be displayed in the classroom.

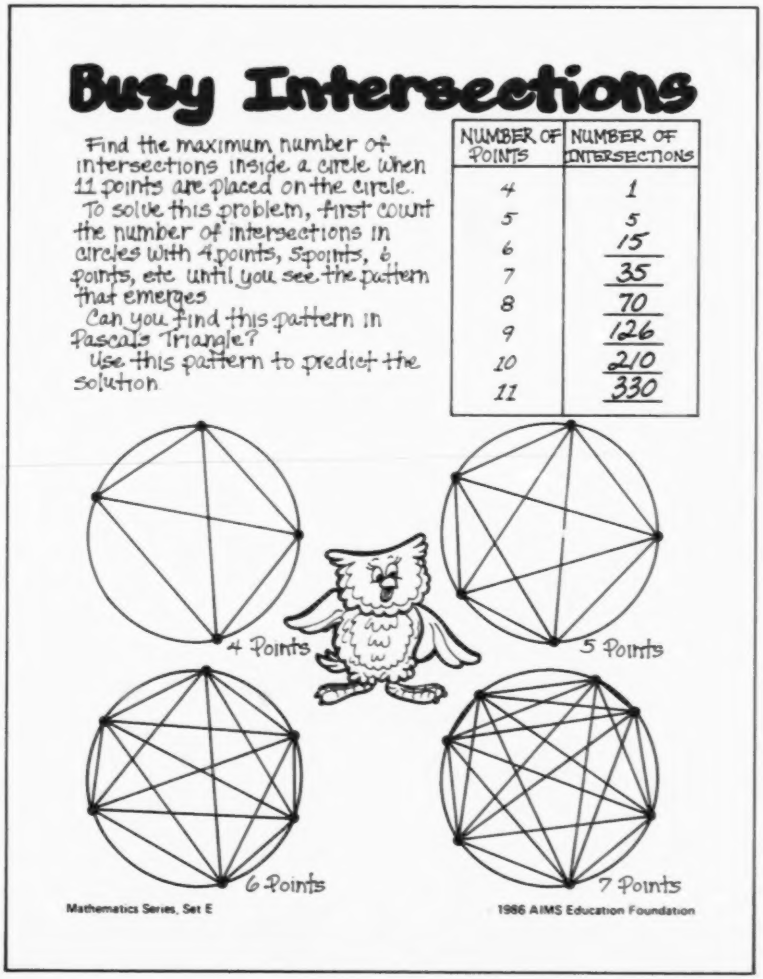
In this problem we will limit our investigation to a Level I solution. After determining the number of intersections for a circle with 4, 5, 6, 7 points, students should see if they can find the pattern in Pascal's Triangle.

The solution is shown below.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1
1 9 36 84 126 126 84 36 9 1
1 10 45 120 210 252 210 120 45 10 1
1 11 55 165 330 462 462 330 165 55 11 1

Number of Intersections

Pascal's Triangle



Busy Intersections

Find the maximum number of intersections inside a circle when 11 points are placed on the circle.

To solve this problem, first count the number of intersections in circles with 4 points, 5 points, 6 points, etc until you see the pattern that emerges.

Can you find this pattern in Pascal's Triangle?

Use this pattern to predict the solution.

NUMBER OF POINTS	NUMBER OF INTERSECTIONS
4	1
5	5
6	15
7	35
8	70
9	126
10	210
11	330

4 Points

5 Points

6 Points

7 Points

Mathematics Series, Set E

1986 AIMS Education Foundation

Busy Intersections

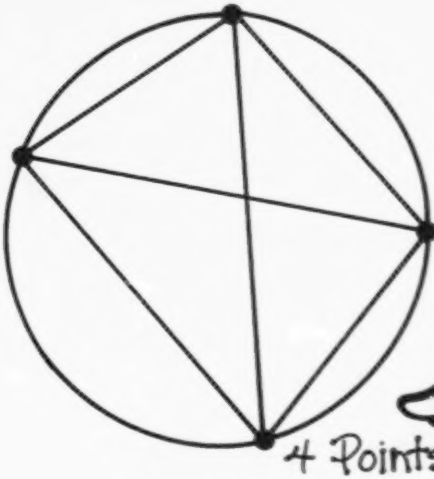
Find the maximum number of intersections inside a circle when 11 points are placed on the circle.

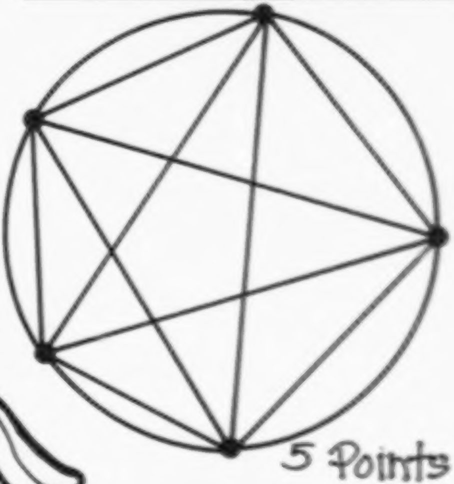
To solve this problem, first count the number of intersections in circles with 4 points, 5 points, 6 points, etc. until you see the pattern that emerges.

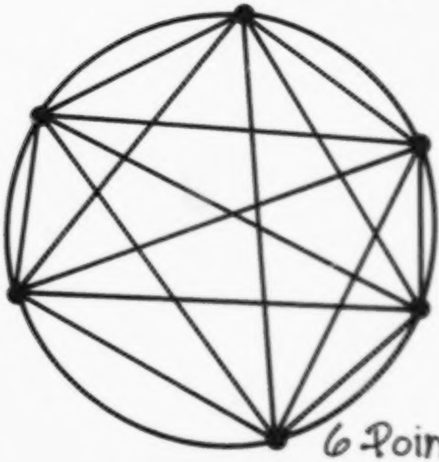
Can you find this pattern in Pascal's Triangle?

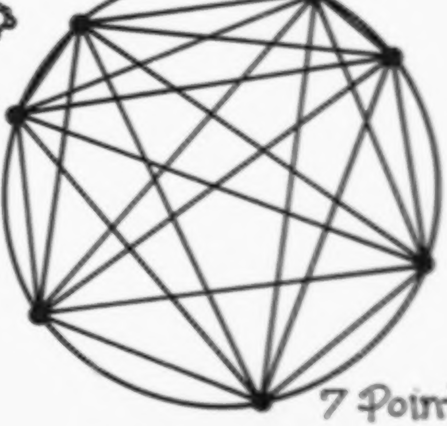
Use this pattern to predict the solution.

NUMBER OF POINTS	NUMBER OF INTERSECTIONS
4	1
5	5
6	______
7	______
8	______
9	______
10	______
11	______


4 Points


5 Points


6 Points


7 Points

MAY THE FORCE BE WITH YOU

I. Topic Area

Force, Energy, and Energy Conservation

II. Introductory Statement

In this group of investigations (May The Force Be With, May The Force Be With You II and Return Of May The Force Be With You, The Great Catapult Caper), the students will be isolating variables in order to learn about the energy balance that is in nature. These lesssons could be used effectively in 7th or 8th grade because of the math concept involved. Or, it could be used in lower grades if the catapult itself, rather than the math, is the emphasis.

III.

Math Skills	**Science Processes**
a. Averaging	a. Measuring and Comparing
b. Measuring	b. Recording data
c. Using formulae	c. Predicting & inferring
d. Ratios	d. Identifying & controlling variables
e. Graphing	

IV. Materials

For each group of five students:

Two 1/4in. diameter x 36in. long dowels

Four cm. ball of clay

One 50 cm. length of 14 guage galvanized wire AND one 25 cm. length of 14 guage galvanized wire.

10-15, 1/4in. x 1 1/4in. fender washers (washers with small holes but a large total diameter)

Pliers

Scale and 60 grams of weights

1 small, empty thread spool

Meter stick

2-10 cm. X 25 cm. pieces of pegboard (with 1/8" diameter holes)

Student worksheet

Chart paper, chalkboard, or overhead projector

V. Key Question

If we drop the same mass (30 grams) from different heights, what effect will that have on the resistance?

VI. Teacher Background

The First Law of Thermodynamics states that there is an energy balance in nature. Energy in = energy out. Mass x gravity x height (mgh) is the potential energy that an object has. Mgh is a measure or a unit of energy. In the catapult lessons that follow the students will do a variety of investigations which will lead them to an understanding of mgh. On one side of the catapult we have the mass, the effort (m), under the gravitational pull of the earth (g), being dropped from a certain height (h). By multiplying these 3 together we have mgh. This side of the catapult is in a potential energy position. Once the mass is released the following chain of events takes place in what is called an energy balance:

$$\underbrace{\text{potential} \rightarrow \text{potential-kinetic} \rightarrow}_{\text{effort arm}}$$

$$\underbrace{\text{kinetic} \rightarrow \text{kinetic} \rightarrow \text{potential} \rightarrow \text{potential}}_{\text{resistance arm}}$$

Once the mass is released, the potential energy is turned into Kinetic energy (the energy of motion) causing the resistance to be forced to a certain height on the other side of the catapult. By controlling variables the students will begin to recognize the relationshop between mass and height and the energy balance that is in nature.

For example: When you know the mass and height of the effort, and you want the height of resistance to remain the same when you are using a different mass, you can calculate:

$$mgh = mgh$$

Gravity cancels itself out because the force of gravity remains the same at 9.82 cm. 2/sec./sec. whether it is on the potential energy side or the Kenetic energy side of the catapult. Thus:

$$40 \times 45 = 50 \times h$$

40gm. x 45 cm. = 50 gm. x ? which means that if a 40 gram weight is dropped form a 45 cm. height, how high do you have to drop a 50 gram weight in order to force the resistance to reach approximately the same height as with the 40 gram weight?

$$50 \times h = 40 \times 45$$

$$50h = 1800$$

$$h = \frac{1800}{50}$$

$$h = 36$$

Therefore, a 50 gram weight dropped from 36 cm. height, and a 40 gram weight dropped from a 45 cm. height, will force the resistance to reach approximately the same height. Errors in the results could be caused by friction from the effort or the resistance, fulcrum not at midpoint, leaning dowels, unevenly distributed weights, etc.

VII. Management Suggestions

1. This lesson is composed of 4 activities (May The Force Be With You to The Great Catapult Caper). However, each activity could be done independently of others. But following the sequence of the lessons would be beneficial to student understanding of the concepts of force and energy. (only the first is included in this issue)
2. The culmination of this series of lessons, The Great Catapult Caper, ties together the elements of the May The Force Be With You lessons and the lever lessons that preceded (Clever Lever and See Saw).
3. If you use other than 14 gauge wire make sure that it is sturdy enough to withstand the force of the weights. To prepare you to teach the lessons make a catapult as you go over the Background Information so that you can experiment as you read. You will also need a model of the catapult for the students to follow as they build their own.
4. Make sure that fender washers are used so that it will be possible to create accurate weights.
5. Students will work in groups of 5 (each member having a different responsibility to complete the experiment).
6. You can either make a large class graph on chart paper (in a similar manner to the worksheet), or be prepared to draw one on the chalkboard, or make a copy of the student worksheet for the overhead projector.

VIII. Procedure

1. Discuss key question.
2. Review the worksheet. Students will observe the results, record, and complete the graph. 3 trials are given for each height so that averages can be computed.
3. Explain responsibilities of work details and then instruct each member of the group to select one job: 1-Create the catapult and platform. 2-Make the weights. 3-Measure and mark the dowels. 4-Observe results. 5-Record.
4. Follow the instructions for making the catapult, platform, and weights.
5. Students will conduct trials, record, and graph.

IX. Discussion

What is the relationship between the height that the effort was dropped and the height that the resistance traveled? (The height of the resistance increased as the height of the drop increased.)

X. Extensions

Discuss the experiment: Which case will make the resistance travel higher, a lighter weight dropped from a higher distance, or a heavier weight dropped from a lower height? Why does this occur? (The lighter weight dropped from the higher distance will force the resistance higher-it's the force that counts!)

XI. Curriculum Coordinates

1. Language Arts
   Create a Word Search using new vocabulary from the lesson: catapult, resistance, effort, fulcrum, calculations, energy, potential, kinetic, etc.
2. History
   Have students research the history of the catapult including the significance of engineers to the war effort, especially Archimedes. The reports can be done individually or with a group, oral or written.

Ed. Note: "May the Force Be With You" is one of the investigations from a forthcoming book on simple machines to be entitled "Machine Shop". The investigations are now being field-tested.

The story-theme of this book begins with an introduction to the cast of characters and to the simple machines. The fact pages are presented in story form in which a situation arises that needs a solution. The various simple machines describe how they could help, given their particular characteristics. The cast of characters is shown in cartoon form, and the fact pages are illustrated in a manner similar to that used in comic strips.

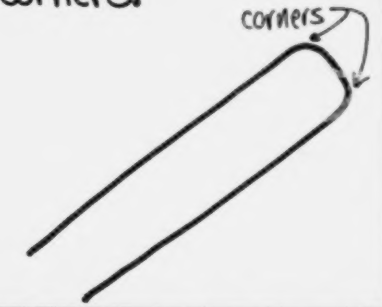
The book is divided into units based on individual machines, with separate sections for work and friction.

At the end of the book the writers have included several puzzles, word searches, and other activity pages, as well as a glossary of commonly used terms dealing with this topic.

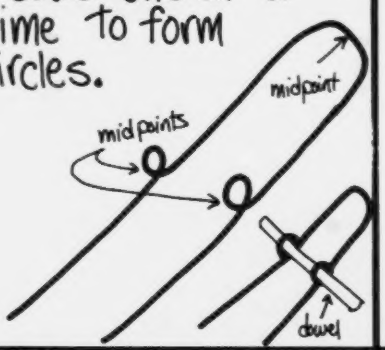
Machine Shop is scheduled for publication in the Fall of 1987.

CATAPULT, PLATFORM, & WEIGHT CONSTRUCTION

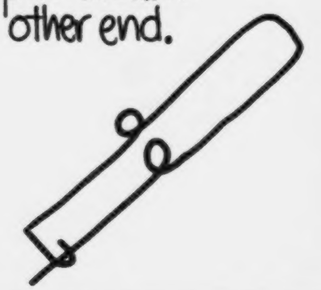
1. CATAPULT: Bend a 50cm wire into a U shape. Use pliers to make corners.



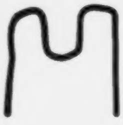
2. Twist the midpoint of the wires around a dowel one at a time to form circles.



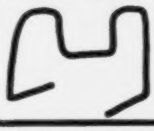
3. Close off the end by bending one side to form a corner and wrap it around the other end.



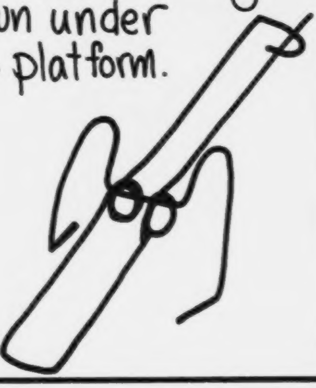
4. PLATFORM: Find the midpoint of a 25cm length of wire. Use pliers to form the M shape shown.



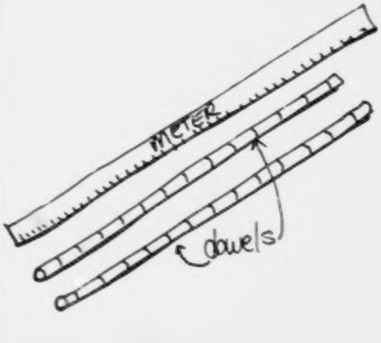
Bend up the ends so that it will stand.



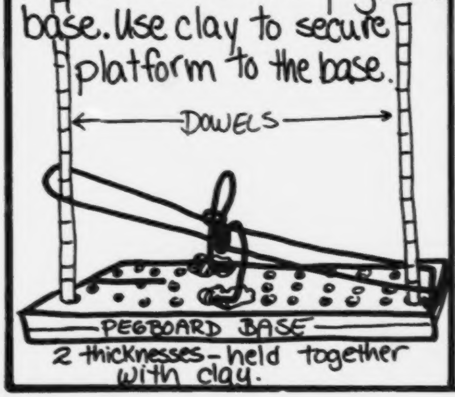
5. Thread the catapult through the platform so that it hangs down under the platform.



6. Use a meter stick. Mark dowels at 5cm intervals.



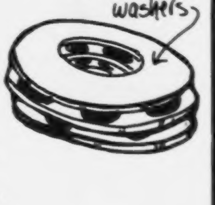
7. Place a dowel at either end of the catapult. Secure dowels in a pegboard base. Use clay to secure platform to the base.



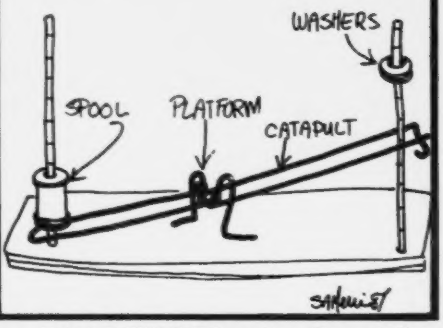
2 thicknesses - held together with clay.

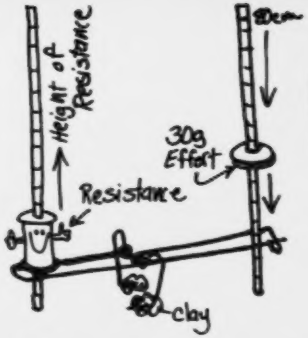
8. Make weights according to the amount needed.

Sandwich dots of clay evenly between washers. Increase the weight by adding more washers. Continue to sandwich with clay.



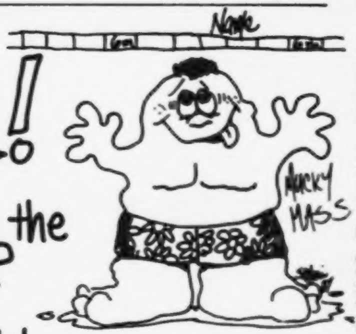
9. Place spool over one end of a dowel. Washer weight goes over the other dowel.





May the Force Be With You!

______________________ Name

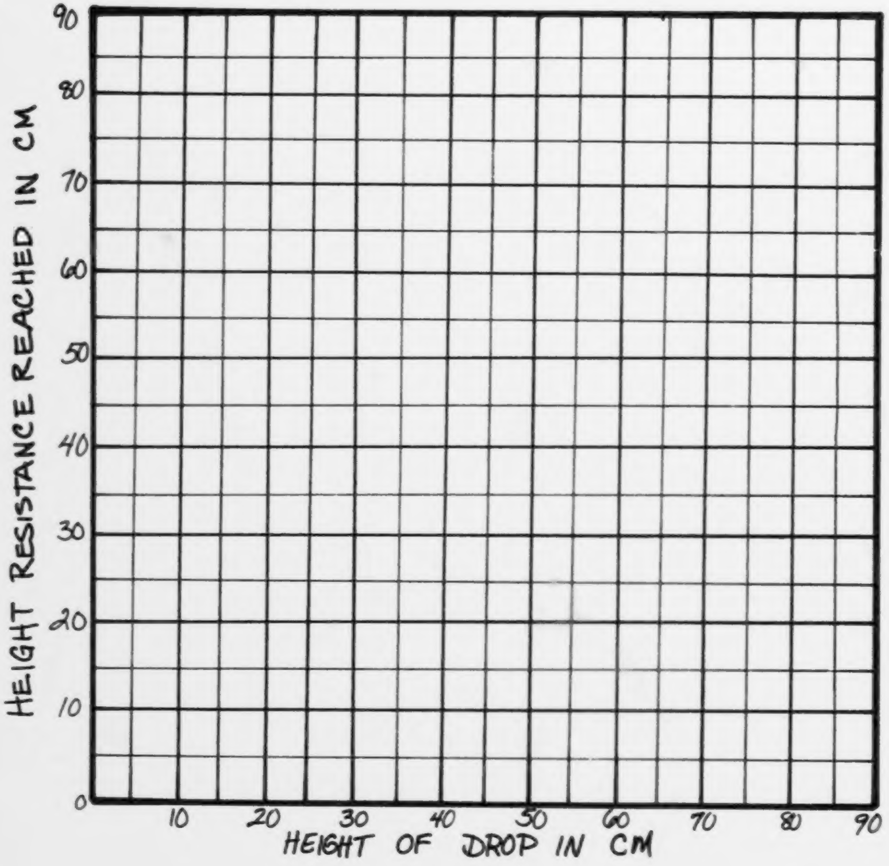


What will be the effect on the resistance when the same mass is dropped from different heights?

Constant: ____________ Variable: ____________

1. Construct the catapult and platform.
2. Make a 30gram weight with washers and clay.
3. Drop the weight (effort) from the heights listed, 3 times each.
4. Measure the height the spool (resistance) reaches each time. Find the average.
5. Make a graph to display results.

EFFORT	HEIGHT RESISTANCE REACHED IN CM			
HEIGHT OF DROP	Trial 1	Trial 2	Trial 3	Average
80 cm				
70cm				
60cm				
50cm				
40 cm				
30cm				



Conclusion?

____

HOME MADE FIRE EXTINGUISHER

GENERAL INFORMATION

Fire extinguishers commonly used in homes and vehicles spread a dry, snowlike solid that changes to a gas under atmospheric pressure. The gas is carbon dioxide (CO_2) which is odorless, colorless and tastless. When it is discharged from the metal container the carbon dioxide gas settles over a fire and shuts off the supply of oxygen in the air that a fire must have to burn. It does this because it is over one and a half times as dense (heavy) as air.

Human beings and animals inhale an air mixture that is about 12% oxygen, 78% nitrogen and 1% other gases. They exhale carbon dioxide that is produced by "oxidizing" (burning) food in their bodies. Green plants take carbon dioxide from the air and give off oxygen when light shines on them. In the light, plants combine carbon dioxide with water to make food. The air is about 0.035% carbon dioxide.

Carbon dioxide has everyday uses. It is used to make cakes rise in an oven because baking powder or yeast in the cake batter releases carbon dioxide. It is used to produce the "fizz" or sparkle in soft drinks, beer, and sparkling wines. It becomes a solid when it is cooled to −109.3°F (−78.5°C) at atmospheric pressure. The solid is called "dry ice" because it does not melt to form a liquid as water does. Instead it changes directly back into a gas.

Although most people don't realize it, chemical reactions take place around us constantly. Burning wood in a fireplace, washing clothes in a washing machine, driving a car, breathing, digesting food, are daily activities during which chemical reactions occur. The average kitchen has all the materials necessary for many exciting chemistry experiments.

The gas produced by the "Home Made Fire Extinguisher" is a result of a chemical reaction. When vinegar (acetic acid) is combined with baking soda (sodium bicarbonate), water and carbon dioxide are produced. The gas that is found inside the jar forces the "air" mixture out. When the burning candle is lowered into the jar, the flame is extinguished because all that remains in the jar is carbon dioxide which doesn't support combustion.

MATERIALS

Use any type of vinegar and baking soda. Empty quart mayonnaise jars are excellent to use for this demonstration.

PROCEDURE

When demonstrating this activity, take time to discuss safety precautions, such as lighting the candle, closing cover before striking match, etc. After procedure number 5 extinguish the candle and lower it into the jar two or three times.

POSSIBLE ANSWERS

1. The candle continues to burn when lowered into both "empty" jars because there is enough oxygen to sustain the flame. There is oxygen in the air above the vinegar and baking soda.
2. When the vinegar and baking soda were mixed, carbon dioxide gas was formed. Because carbon dioxide is "heavier" than air, it remains in the jar and forces out the "fresh air". Carbon dioxide does not have the oxygen that is necessary to keep the candle burning.
3. The CO_2 gas that was produced smothers the flame the same as the gas sprayed from a fire extinguisher.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Discuss the use of a portable fire extinguisher and why it is important to have one in the home and in a vehicle. Also discuss what extinguishes a flame from a match when a person blows it out. It is the force of the wind or the carbon dioxide exhaled by the person.

1. Repeat procedure 5. See how many times a candle can be lowered into the jar and be extinguished before the CO_2 has dissipated.
2. Repeat procedure 5 and cover the mouth of the jar with a book. Leave overnight and lower a candle into the jar 24 hours later. Did the carbon dioxide gas extinguish the candle flame?
3. Have one of the students do the experiment at home and cap the jar for one week. Remove the cap from the jar and lower a burning candle into it. Was there enough Carbon dioxide to extinguish the flame? Caution student to wait for at least two minutes before capping the jar after mixing the vinegar and baking soda — it is suggested that the teacher follow this procedure before sharing with the class.

Homemade Fire Extinguisher

Materials:

- 2 empty quart jars
- Matches
- Small candle
- 10" piece of wire
- Baking soda
- Spoon
- Vinegar

Procedure:

1. Wrap the wire around the candle.
2. Light the candle and slowly lower it into each of the empty jars.
3. Put 2 tablespoons of baking soda in one of the jars and 2 or 3 ounces of vinegar into the other one.
4. Repeat procedures 1 & 2 by lowering the burning candle into the jar with baking soda and then into the one with vinegar.
5. Pour the vinegar into the jar with the baking soda, wait for about 10 seconds and then lower the burning candle into the jar.

Questions:

1. What happened when the burning candle was lowered into the jar filled with air? Into the jar with baking soda? Into the jar with vinegar?

2. What happened when the vinegar was mixed with the baking soda?

3. What happened when the burning candle was lowered into the mixture?

The Joys of Jelly Beans

I. Topic Area
Science process skills and jelly beans.

II. Introductory Statement
Students will use jelly beans to estimate, count, compare and graph.

III.

Math Skills	Science Processes
a. Estimating	a. Sorting & classifying
b. Counting	b. Hypothesizing
c. Comparing	c. Recording data
d. Graphing	d. Generalizing
e. Column addition	e. Using information to solve problems

IV. Materials
Jelly beans
Crayons or colored pencils

V. Key Question
How many jelly beans are in the jar?

VI. Background Information
The teacher may wish to purchase one large bag of jelly beans and find an appropriately decorative jar in which to display them. Perhaps an old fashioned canning jar or an apothecary jar through which students may view the full assortment of candy would be available.

VII. Procedure

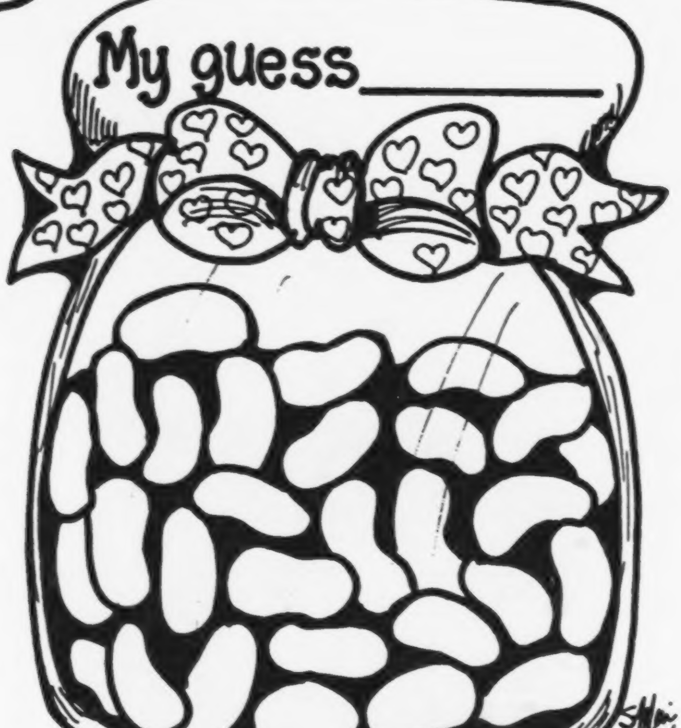
1. The teacher will display the jar of jelly beans and initiate a sharing time during which students are encouraged to voice their estimates as to how many jelly beans are in the jar. The teacher records these estimates on the chalk board or overhead projector.
2. A discussion of the shared answers may then ensue as the teacher asks creative questions while the students observe the numbers on the overhead. Such questions may include: Who sees a number that is the same as their age? Is there a number with a 3 in the tens place? Do you see a number that is the same as 5 plus 4? The questions will vary in complexity according to the grade level ability.
3. The teacher will then distribute to each small group of 4-5 students a small handful of the jelly beans removed from the jar until all jelly beans are distributed. She (or he) may point out that the job of counting all the jelly beans becomes much easier when shared in small portions.
4. Each student then estimates or guesses the total number of jelly beans in their fistful and the number of each color and makes a record on the student activity page.
5. Each group then counts the jelly beans and sorts by color on his sorting sheet. Record the total count and the number of each color.
6. Each student then makes a graph of the number and colors of jelly beans in his group. Either the horizontal bar graph or the vertical bar graph may be used. In either situation, a real graph may be constructed first by placing the jelly beans directly on the page - one to a square or one to an oval. A representational graph may be drawn by having each student simply color in each space as they remove each jelly bean from the paper.
7. In order to discover the total number of all the jelly beans in the jar students will share the information from each group and the teacher may use the vertical graph in a transparency form and record the number of each color in the appropriate columns. Thus, the red column may show a column of numbers such as 5, 4, 3, etc. Vertically the total number of each color in the jar will be displayed. Horizontally the numbers will total the number of jelly beans in each small group.

VIII. Discussion Questions

1. Let's compare our estimates to the actual count in the jar. How many of you were within ten of the number? five?
2. Which color jelly bean was the most common?
3. How are the jelly beans alike and how are they different?
4. Why do you suppose that jelly beans often appear in Easter baskets?
5. How many "counting Teddy Bears" did our jar of jelly beans weight?
6. Choose jelly beans of two colors. Make a jelly bean "train" that shows a repeating pattern. Try it again with three different colors.
7. Fair share the jelly beans in your group with the members of your team. How many did each person get? How many are left over?

Name ____________

JELLY BEANS



My guess ________

The Easter Bunny just hopped by
And left these jelly beans in our jar!
Before you begin to count them,
Try to guess how many there are!

Quickly, come up with your answer
And write it on the lid.
Now count up all the beans
To see how well you did!

My Name: ____________________

Jelly Beans Sorting Sheet

yellow

black

red

orange

pink

Make a record of each number counted.

white

purple

green

My Name ____________________

JELLY BEANS

I counted this many beans:

____ red 🫘's

____ orange 🫘's

____ yellow 🫘's

____ green 🫘's

____ purple 🫘's

____ pink 🫘's

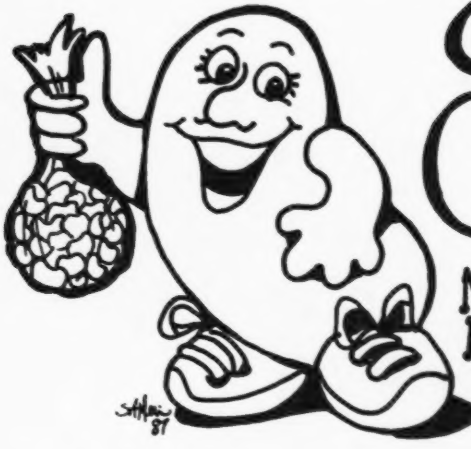
____ white 🫘's

____ black 🫘's

____ total 🫘's

____
Product Tester

JELLY BEANS



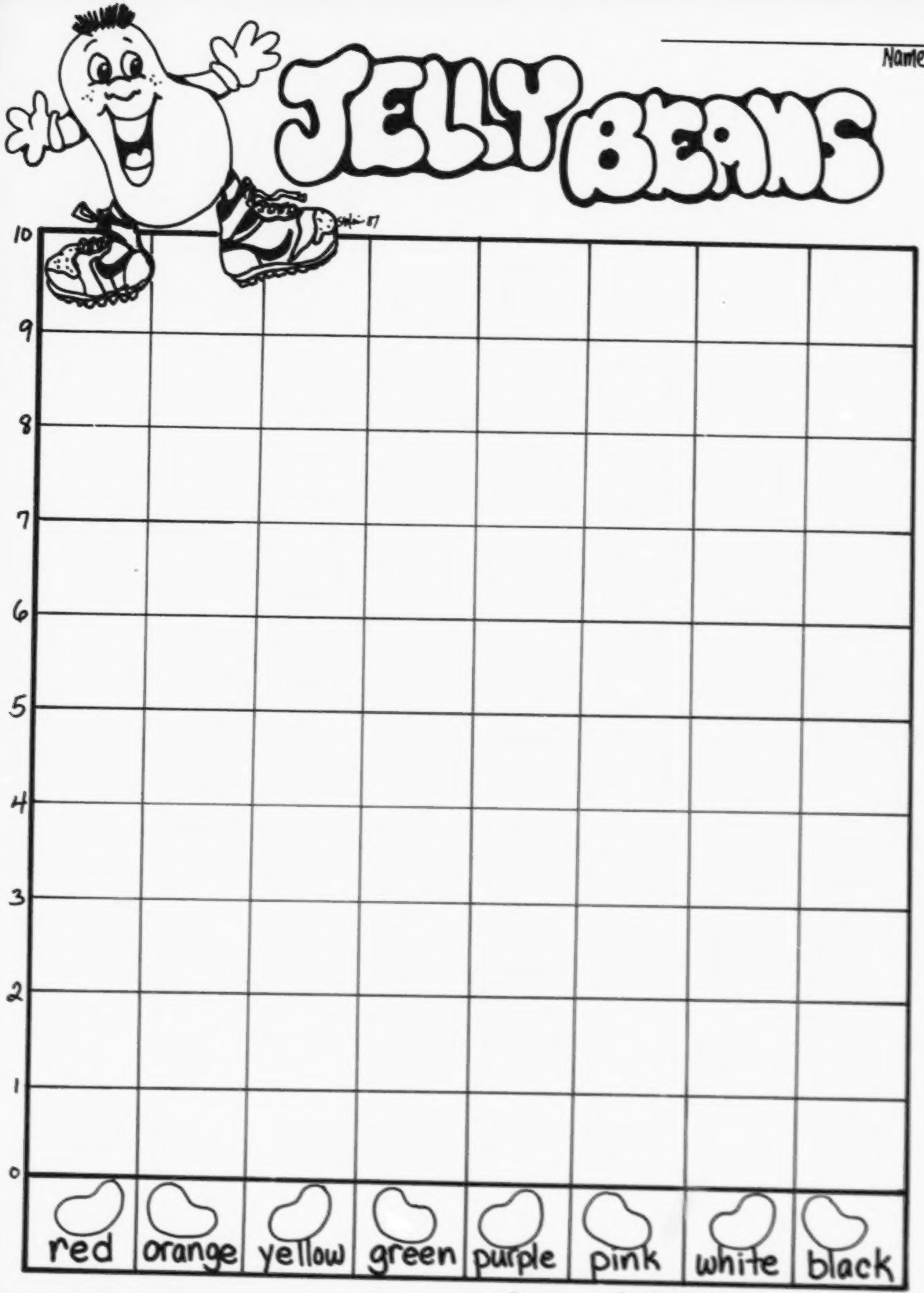
My group got a bag of jelly beans.

Our bag cost ____ and weighed ____.

I guessed that there were this many:	My group counted this many:
____ red 🫘's	____ red 🫘's
____ orange 🫘's	____ orange 🫘's
____ yellow 🫘's	____ yellow 🫘's
____ green 🫘's	____ green 🫘's
____ purple 🫘's	____ purple 🫘's
____ pink 🫘's	____ pink 🫘's
____ white 🫘's	____ white 🫘's
+ ____ black 🫘's	+ ____ black 🫘's
____ total 🫘's	____ total 🫘's

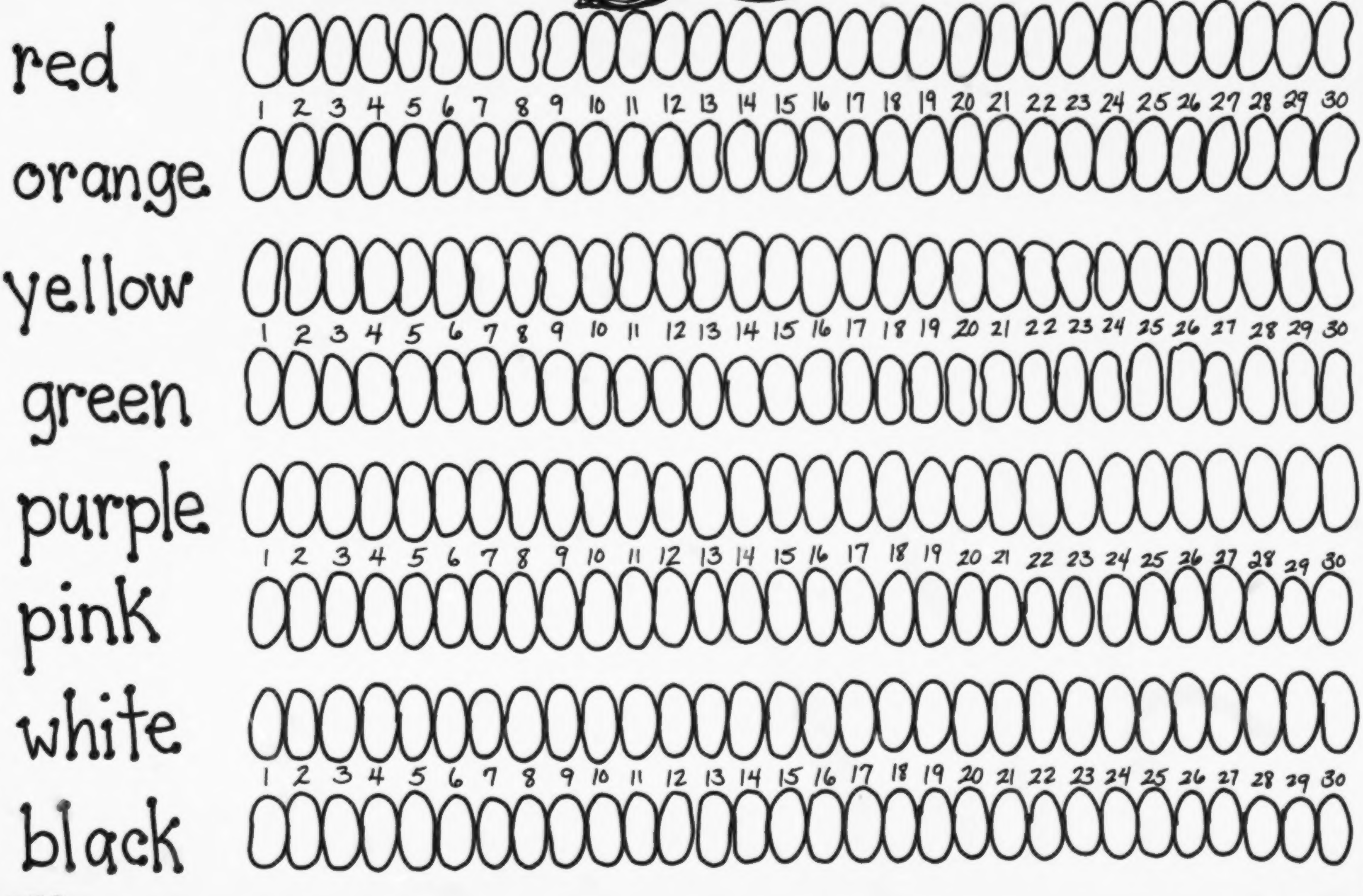
JELLY BEANS

____
Name



_____________________ Name

JELLY BEANS



Jelly Belly Jargon

I. Topic Area

Integrating science process skills and language arts.

II. Introductory Statement

Students will sort Jelly Bellys by flavor and name each flavor with an appropriate adjective and compare to company descriptors.

III.

Math Skills	Science Processes
a. Attributes	a. Classifying & identifying
b. Counting	b. Recording data
c. Graphing	c. Drawing conclusions

IV. Materials

One small bag of assorted Jelly Bellys per group

Colored pencils or marking pens

V. Key Question

How many flavors can you find and name with vivid adjectives?

VI. Background Information

Each bag of assorted Jelly Bellys has the flavors identified on the wrapper. Remove the candy from the wrapper and distribute in plastic Zip Lock baggies. Save the wrappers for comparison later in the activity.

VII. Management Suggestions

Students work effectively in small groups of 4-5 sharing a bag of Jelly Bellys.

VIII. Procedure

1. Students will predict the number of flavors in a bag of Jelly Bellys. Count and sort the candy by color. Make a visual record of each different color on the recording page.
2. Weigh and record the mass of the bag of Jelly Bellys.
3. Find and record the mass of one Jelly Belly.
4. Record the cost of the bag and the cost of one Jelly Belly.
5. Take turns selecting one color and tasting it. Then identify the flavor and name it. Record the name using an appropriate adjective in the column to the left of the pictured color.
6. Compare the names of flavors the group has chosen to the names the manufacturer provides on the wrapper.
7. Make a graph of the flavors and colors in the bag.
8. Record a conclusion or generalization about the flavors of Jelly Bellys.

IX. Discussion

1. Are there a fixed number of Jelly Bellys in each bag?
2. How does the number of colors relate to the number of flavors?
3. How close does the weight of the Jelly Bellys match the stated net weight on the package?
4. What new flavors can you create by combining one flavor with another?
5. What colors or flavors seem to dominate a package?
6. What is the range of numbers of different colors and flavors in a bag? The average number?

X. Extensions

Make believe that you have the opportunity to create a bag of Jelly Bellys that will be marketed to "aliens" from other planets. What colors and flavors would you include? What names and adjectives would you chose?

____
Consumer Reporter

Members of Team:
____
____
____
____

How many flavors are in a bag of Jelly Bellys?

I think that there will be _____ flavors.

1. Make predictions, then open the bag, count and sort by colors.
2. Gather other statistics about jellies.
3. Record below.

	Prediction	Real Count
Group's total number of Jelly Belly :	_____	_____
Class total number of Jelly Belly:	_____	_____
Mass of bag in grams :	_____	_____
Mass of one jelly in grams:	_____	_____
Cost of the bag :	_____	_____
Cost of one jelly belly :	_____	_____

4. Now comes the tasty part of the investigation. Take turns tasting the jellies and deciding what flavor each color is. Record names for each of the flavors on the next page. Be creative. Then compare your flavor names to the company's names.

Jelly Belly Flavors

____
Consumer Reporter

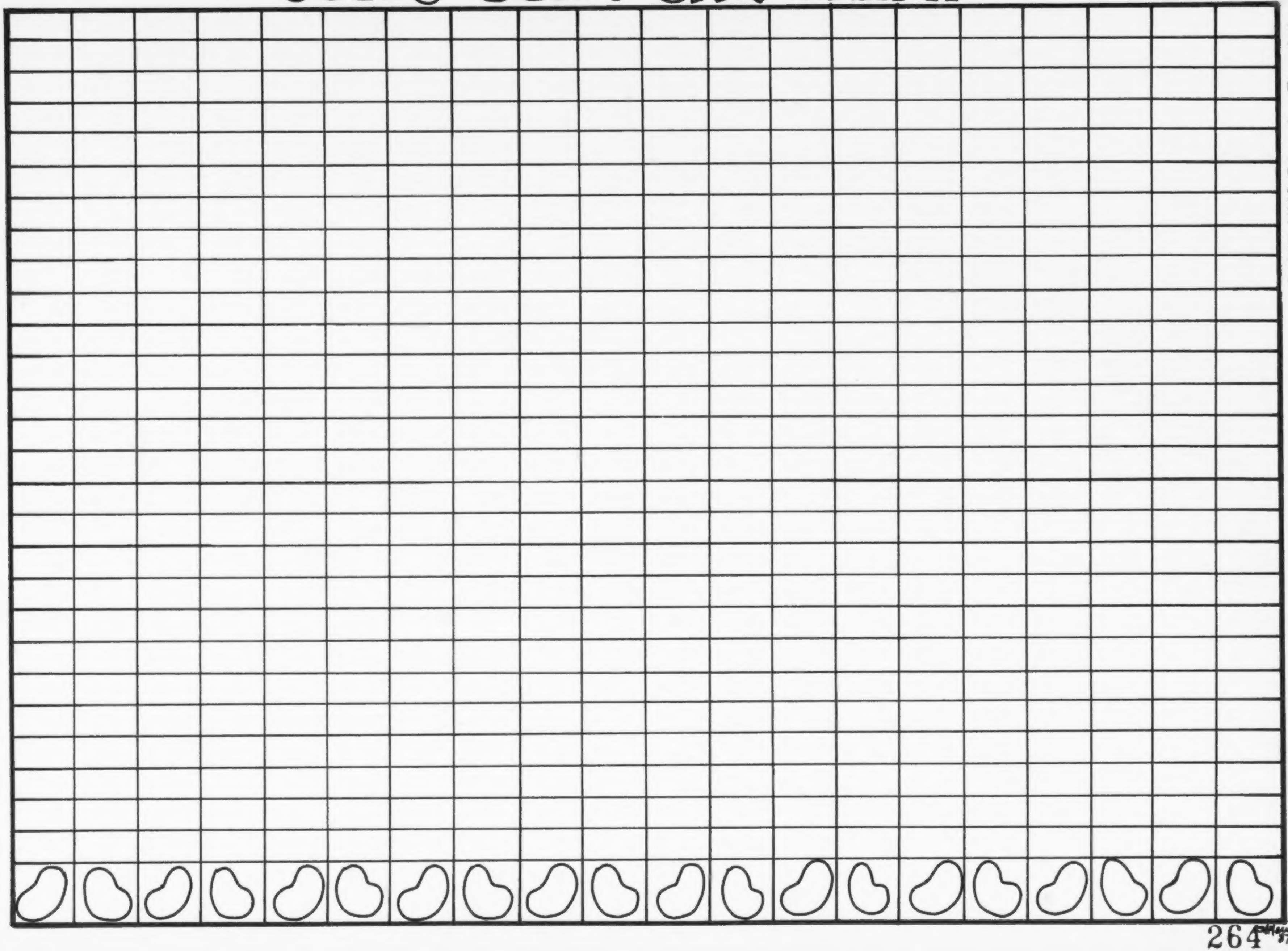
Group Names	Color	Company Names

Conclusion: ____

____

JELLY BELLY BAR GRAPH

Name: ____________________



Application to Host Project AIMS Workshops

Summer, 1988

This application to host a Project AIMS Workshop during the Summer, 1988 is based on the following conditions:

a. Each workshop will be of five days duration and include 30 hours of instruction. The emphasis will be on the "hands-on" integrated Mathematics/Science activities drawn from the extensive resources of the AIMS program.

b. Participants will receive: 30 hours of instruction, primarily hands-on; numerous handouts of AIMS materials with duplicating rights; and their choice of three AIMS publications.

c. The basic cost per participant without college credit is $170. Two semester units of college credit from Fresno Pacific College is available for an additional $50 tuition fee. College credit is optional.

d. The host educational agency agrees to provide appropriate classroom space and related services at no cost to the Foundation. The classrooms shall have a capacity for 40 and be equipped with tables and chairs and an overhead projector. The host agency also agrees to cooperate in promoting participation.

e. The AIMS Education Foundation will pay for all instructional costs; the housing, meals, and travel costs of instructors; and workshop materials and supplies. As needed, the Foundation will loan the necessary science equipment required for the workshop.

f. All workshops will be offered with three sections. Generally, these will be K-2, 3-5, and 6-9 but minor adjustments will be made as needed. The minimum enrollment per workshop section is 30 and the maximum is 40. Pre-registrations received at least two months prior to the date of the workshop will be used to determine that the minimums have been met and the maximums have not been exceeded.

g. The AIMS Education Foundation will announce all workshops in the AIMS Newsletter and provide the sponsoring organization with promotional materials.

* *

Application

1. Name and address of the Sponsoring Educational Agency:

____

____

____ Telephone (____) ______________

2. Name of person authorized to submit application:

____ Telephone (____) ______________

Signature ______________________________________ Date ______________

3. Proposed location of Workshop:

____

____

____

4. Requested dates for Workshop:

First Choice ______________________ Second Choice ______________________

5. Anticipated enrollment from Sponsoring Agency: ______________________

6. Will participants from other districts be welcome? ______________________

Submit to: **AIMS Education Foundation**
P.O. Box 7766
Fresno, California 93747

AIMS Workshop Schedule for the Summer, 1987 Completed

Sixteen AIMS Workshops will be offered at locations other than the Fresno Pacific College Campus during the summer of 1987. It is anticipated that this will provide space for 1600 teachers in addition to those taking the workshops on the Fresno Pacific College Campus to participate.

Graduate credit is offered for the courses taken on campus and in-service credit is available for workshops attended at the sixteen off-campus sites. Two semester units of credit are available for each workshop.

It is of utmost importance for teachers planning to attend these workshops to submit their pre-registration as early as possible. Several of the workshops are nearly filled at this time. In every case, teachers from sponsoring districts have priority but teachers from out of district are welcome.

The schedule by dates and location is given on the pre-registration form.

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name ______________________ Social Security No. ______________
Street ______________________ City ______________
State ______________ Zip ________ Home Phone (______) ______________
School District ______________________________________
School ______________ Grade Level ________ School Phone (______) ______________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

☐ Davis, California June 15-19
☐ Fairfield-Suisun Unified School District, June 22-26
☐ Edmonds (Washington) School District, June 22-26
☐ San Jose Unified School District, June 22-26
☐ Northern Arizona University, Flagstaff, Arizona July 6-10
☐ Ventura Unified School District, July 13-17
☐ Placentia Unified School District, July 13-17
☐ Mother Lode Union School District, July 20-24
☐ Sacramento (TEC Center), July 27-31
☐ Berryessa Union School District (San Jose), August 3-7
☐ Poway Unified School District, August 10-14
☐ Hesperia School District, August 10-14
☐ El Monte City School District, August 17-21
☐ Goleta Union School District, August 17-21
☐ Azusa Union School District, August 24-28
☐ Bremerton (Washington) date to be announced

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

AIMS NEWSLETTER
A Publication of the AIMS Education Foundation
A Non-Profit Tax-Exempt Foundation
Volume 1, Number 9 April, 1987 ©AIMS Education Foundation

Foundation Seeks AIMS National Leadership Candidates

The rapid growth in the demand for AIMS workshops in all parts of the nation has created the urgent need for more trained AIMS workshop leaders and consultants.

The AIMS Education Foundation encourages classroom teachers, resource teachers, and staff development personnel to give serious consideration to becoming part of the AIMS National Leadership Network. This is an excellent opportunity for professional growth and service. The need is particularly acute for workshop leaders who are willing to conduct workshops, teach AIMS courses, and serve as AIMS consultants in other regions as well as in their own districts.

For the first time, the complete training program is now available during summer sessions. This makes it possible for candidates from all parts of the nation to participate.

Participants will receive a total of 300 hours of instruction during eight weeks of training, four weeks in each of two consecutive summers. Each participant will provide a minimum of 50 hours of staff development for implementing and using AIMS in each academic year following a summer session as the field work component of the program.

Upon successful completion of this program, candidates will be promoted to membership in the AIMS National Leadership Network. This will qualify them to conduct AIMS workshops, teach AIMS in-service courses for college credit, and serve as AIMS consultants.

The AIMS Education Foundation will draw from this membership to staff its many workshops and courses planned for 1988 and beyond. School districts will be able to consult the Network directory and contract with members to perform services.

The AIMS Education Foundation subsidizes approximately $2,000 of the $4,600 total cost. This reduces the net cost to $2,600, not including optional tuition for college credit or lodging and meals. Both of these are available at unusually reasonable rates as described on Page 32.

Schools are encouraged to provide the financial support for candidates and then reap the many direct benefits from the local staff development component of the program as well as the wealth of materials that are included. Sponsoring agencies will quickly realize the cost-effectiveness of the investment.

Where school support is not forthcoming, educators are encouraged to fund their own participation and then enjoy the many benefits from their new professional status. Some of the current candidates who are funding their own participation are finding that the demand for AIMS workshops is so great that they are more than earning the cost of the program even while they are in training! This is an unprecedented opportunity to grow professionally and at the same time enjoy the accompanying financial rewards!

Candidates may earn graduate credit applicable to the Master of Arts in Education Degree, Mathematics/Science emphasis, with the payment of a small additional tuition fee. College credit, however, is optional.

AIMS is much more than a set of materials! While the materials are easy to use and stimulate strong student interest, it is the concern of the program directors that the full depth of the program be known to teachers using AIMS in order to actualize maximum benefit. Participants in the National Leadership program will receive training in all the dimemsions of AIMS and be able to share these significant elements with their collegues. The anticipated result is that the benefits from using AIMS will be fully realized.

The program for candidates entering in 1987 is as follows:

Summer, 1987: AIMS National Leadership Institute,
July 6-7
Science Festival, July 20-31
Summer, 1988: Festival of Mathematics, June 20-July 1
AIMS National Leadership Institute,
July 11-22

During the two AIMS National Leadership Institutes the focus will be on the philosophy, underlying learning theory, methodology, and content of the AIMS program, including newly developed materials that are constantly emerging. The learning model, classroom management, and related factors will receive a strong emphasis.

The Science and Mathematics Festivals provide a unique and stimulating opportunity to explore these two subject matter areas in depth. Several nationally recognized mathematics and science educators join the AIMS faculty to provide a rich and unforgettable experiences. Among them are Dr. Lola May in mathematics and Dr. Verne Rockcastle of Cornell University and Dr. Joe Abrascato of the Univeristy of Vermont in science.

This issue contains an up-dated description of this program with additional details and an application form on Pages 30-32.

Readers of the AIMS Newsletter are encouraged to give serious consideration to this opportunity! You have until June 20 to submit your application.

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $22.50 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May, making available the entire content of vital articles and the forty or more new AIMS investigations and thirty science and mathematics posters. Address all correspondence to **AIMS Newsletter,** P. O. Box 7766, Fresno, California 93747. **Volume 1, No. 9.**

EDITORS . . . . Arthur Wiebe, Judith Hillen
STAFF ARTIST . . . . Sheryl Mercier
OFFICE MANAGER . . . . Sheryl Bishop
PROGRAM DIRECTORS:
Fresno Pacific College Math/Science Project . . . . Lawrence E. Ecklund
AIMS Education Foundation . . . . Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes . . . Ted Ostrander
Project AIMS . . . . Judith Hillen, Arthur Wiebe
Project SETUP . . . . Jim Wilson, Ted Ostrander
Arthur Wiebe, Jim Greco

AIMS EDUCATION FOUNDATION
PRESIDENT . . . . Arthur Wiebe, Ed.D.
VICE-PRESIDENT . . . . Wilbert Reimer
SECRETARY . . . . Lawrence Ecklund
TREASURER . . . . Jon Hillen
ACCOUNTANT . . . . Robert J. Dwyer
STAFF ARTIST . . . . Sheryl Mercier

Duplication Privileges and Restrictions

The financial resources for the continued research, development, and dissemination of Project AIMS materials are derived solely from the sale of books, posters, and AIMS Newsletter.

It is, therefore, of utmost importance that all educators and educational agencies comply with the privileges and applicable restrictions for duplication.

It is the intention of the AIMS Educaiton Foundation to make its publications available at reasonable cost. Therefore, a school is granted the right to make 200 copies of any of the materials in any of the publications that have been purchased for use by teachers at that school site. If more than 200 copies are to be made a supplementary agreement must be negotiated with the AIMS Education Foundation.

Workshop leaders may make up to 200 copies of any of the materials in the same manner as schools. However, only student pages may be so duplicated. Copies of the teacher's manual may be made for a maximum of one-fourth of the investigations used in a workshop. Teachers receiving copies from workshop leaders may duplicate no more than 35 copies of student pages or enough to use the lessons one time with their class. Any further duplication without the purchase of the materials is strictly forbidden.

All educators conducting AIMS workshops are expected to explain the Model of Mathematics and consistently refer to it as the activities are presented. This Model is the basis upon which the AIMS program rests and its understanding is necessary to achieve the primary objective of AIMS.

If an education agency publishes a newsletter or other form of publication for distribution to multiple sites, no more than 200 copies may be made of any of the materials without permission from the AIMS Education Foundation and the payment of an additional fee. Further, such multiple-site newsletters may duplicate no more than one science activity and one mathematics activity from each issue of the AIMS Newsletter.

At any time that AIMS materials are duplicated the AIMS Education Foundation copyright must appear. In the case of workshops and newsletters, information regarding the availability of AIMS publications and the fact that they may be ordered from the AIMS Education Foundation must be noted.

Any violation of these conditions that result in the evasion of purchases through disregard of these restrictions is detrimental to the program of the Foundation and is strictly prohibited.

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Subscriptions are accepted on this annual basis only. Any subscription entered at any time of the year will receive all of the issues, August through May, of that year.

Each of the issues, beginning with March, 1987, includes the following:

- ★ four or more new AIMS investigations with at least one at each grade level: K-2, 3-5, and 6-9
- ★ one 8.5 x 11 inch blackline master science poster
- ★ two 8.5 x 11 inch blackline master mathematics posters from two different series
- ★ information about the broad range of AIMS activities
- ★ AIMS workshop information
- ★ activities of the AIMS National Leadership Network

The AIMS Newsletter also includes timely articles on such topics as problem solving; integration of mathematics/science/language arts, etc; how school districts are implementing AIMS in a systemmatic manner; new publications of the AIMS Education Foundation; information about conferences in which AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc.

First year subscriptions are still available at $20.00 per year. The new subscription price for 1987-8 is $22.50.

Check One:

____ Renewal subscription for 1987-8, $20.00
____ New Subscription for 1987-8, $22.50
____ Purchase of 1986-7 packet containing all ten issues, $22.50 (available May, 1987)
____ Purchase of 1986-7 packet containing all ten issues and New 1987-8 subscription, $40.00

Subscription Information:

Name: ____________________
Address: ____________________
Street
____
City State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, Ca 93747

★ THIS ISSUE ★ THIS ISSUE ★ IN SUMMARY ★ THIS ISSUE ★ THIS ISSUE ★

Ready for the next step in your professional growth?
If becoming an AIMS workshop leader appeals to you as an opportunity for professional advancement, you will want to give thoughtful attention to the AIMS National Leadership Training Program. **See Page 1.**

AIMS Summer Workshops are filling fast!
Today is the appropriate time to pre-register for the AIMS Summer Workshops. A number of the workshops will be closed to further registration during the next two weeks. Fortunately, it was possible to add a second workshop in the San Diego area since the Poway Workshop was filled to capacity. We anticipate this to be the last addition. **See Page 4.**

"Triangle Mysteries" provides a challenge
This third in a series dealing with "tinkertoy math" provides abundant opportunities for problem solving Students can explore this problem at the trial and error level, occasionally rise to the use of logic, or use logic based on previous experience throughout the process. The extensive discussion of the problem is intended to provide the teacher with a comprehensive background and several ways of arriving at the ultimate solution. **See Page 5.**

"Predictable Patterns" should keep your students solving problems
Predictable Patterns has students look at the beginning of a sequence, determine a pattern, and then use it to predict the next numbers. **See Page 8.**

Sandy Magnet
Every molecule has an attraction for other molecules. In a plain bar of iron the molecules are randomly arranged so their attraction for each other cancels out. In a magnetized bar the molecules are lined up in rows with their north poles pointing north and south poles pointing south. They all pull as a unit and can attract metal objects outside the bar. In Sandy Magnet, students experiment with magnetism. **See Page 10.**

Teddy Bears continue to explore mathematics and science
This issue contains two Teddy Bear investigations of a slightly different type. Here students in the early and middle grades must use logic to determine the answer. These are only a few of the logic activities and other science investigations that will be included in the "Teddy Bears Investigate Their World" book designed for students in grades 2-6. This exciting new volume is currently in the final stages of development. August, 1987 is the target publication date. **See Page 12.**

"The Leafy Facts" activity brings spring into your classroom
Two investigations dealing with the characteristics and classification of leaves are included in this issue. Several attractive and helpful fact pages are included. This is an excellent time of the year for this particular type of investigation. **See Page 16.**

"T.V. Adventure" makes students aware of television advertising
What is the average number of television ads per hour? What type of ads are shown and which predominate? Does the hour of the day, evening, or week make a difference as to what types of ads are shown? This is one of the investigations that will appear in the books "Probably So". Publication of the book had been delayed to complete several additional investigations and the field-testing. **See Page 23.**

"Watch What You Eat" studies television food ads
A sequel to "T.V. Adventure", this investigation has students studying the type, frequency, and probability of seeing a food ad on television at various times of the day and week. This investigation will also appear in the book "Probably So." **See Page 26.**

Computer courses galore offered in Fresno Pacific Summer Program
You won't be able to attend the classes by Fresno Pacific College near London, England (see Page 4), but there are excellent options among the courses available on the Fresno Pacific College campus. The college offers a special Computer Competency Certificate for serious students of the educational use of computers. **See Page 28.**

Fresno Pacific to Offer Computer Courses in England

The Department of Defense Dependents Schools, Atlantic Region has selected Fresno Pacific College to offer a Computer Institute near London, England on June 22-July 3, 1987.

Two adjunct faculty of the Fresno Pacific Math/Science Project will serve as the visiting instructors. Harlie Smith will teach a course in Integrated Systems and Martin Suey will coordinate the software evaluation program and introduce the participants to Project SETUP materials.

The program proposed by Fresno Pacific was selected from a number submitted by various colleges and universities.

The extensive on-campus computer education program is described in detail on Pages 28-29.

Second San Diego AIMS Workshop Scheduled

Goleta Combined with Ventura

Due to the heavy pre-registration for the AIMS Workshop hosted by the Poway Unified School District, August 10-14, a second AIMS Workshop has been scheduled for the San Diego area.

The AIMS Education Foundation will offer this workshop on July 13-17 at the San Diego Office of Education, 6401 Linda Vista Road, San Diego.

The instructional team for both the Poway and this added workshop consists of Brian Tash, Joanie Janis, and Janet Patti.

The second change in the summer program is that the workshops for Goleta and Ventura will be combined with Ventura Unified School District serving as host on July 13-17.

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name ______________________ Social Security No. ______________________

Street ______________________ City ______________________

State ______________ Zip ________ Home Phone (____) ______________

School District ____

School ______________ Grade Level ________ School Phone (____) ______________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

- ☐ Davis, California June 15-19
- ☐ Fairfield-Suisun Unified School District, June 22-26
- ☐ Edmonds (Washington) School District, June 22-26
- ☐ San Jose Unified School District, June 22-26
- ☐ Northern Arizona University, Flagstaff, Arizona July 6-10
- ☐ Ventura Unified School District, July 13-17
- ☐ Placentia Unified School District, July 13-17
- ☐ San Diego Area, July 13-17
- ☐ Mother Lode Union School District, July 20-24
- ☐ Sacramento (TEC Center), July 27-31
- ☐ Berryessa Union School District (San Jose), August 3-7
- ☐ Poway Unified School District, August 10-14
- ☐ Hesperia School District, August 10-14
- ☐ El Monte City School District, August 17-21
- ☐ Azusa Union School District, August 24-28
- ☐ Bremerton (Washington) date to be announced

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

Triangle Mysteries

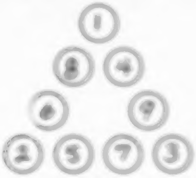
This triangle hides many secrets that are waiting to be discovered by the avid problem solver. The numbers 1-9 are to be placed into the circles in an arrangement that will result in the sums along each leg of the triangle being equal.

Problem solving ability is based on having experience with a broad range of techniques from which to draw one that is appropriate for a given situation. Problem solvers need to begin by asking, "Have I seen something like this before?" In this instance, the problem looks suspiciously like the challenge posed by "The Fascinating Triangle" which appeared in the March issue of the Newsletter. In that experience we learned several important principles.

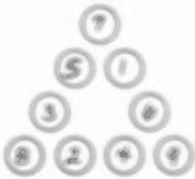
1. The numbers placed at the vertices are twice as powerful as those placed in the other circles.
2. If we found the sum of all of the numbers used and added to that the sum of the numbers used at the vertices, we should obtain a multiple of 3 whenever there was a chance of finding a solution.
3. The lowest sum is obtained when the three smallest numbers are placed at the vertices; and the largest sum is obtained when the three largest numbers are placed at the vertices.

Let's see whether we can make use of these principles in this more complex triangle.

First, the sum of the numbers 1-9 is 45. If we place the numbers 1,2, and 3 at the vertices we must add their sum, 6, to 45. The new sum is 51. 51 is a multiple of 3 and, therefore, all is well so far. 51 divided by 3 is 17. 17 is the candidate for a solution and if it yields a solution it would be the one with the smallest sum. Not surprisingly, we have a solution.



Let's try the reflection of this solution: finding the largest possible sum by using the three largest numbers at the vertices. The sum of 7, 8, and 9 is 24. 45+24=69, another multiple of 3. This is encouraging! 69 divided by 3 is 23. So, 23 is our new candidate. If it yields a solution, it will represent the largest possible sum. Again, we experience success. We have a solution.



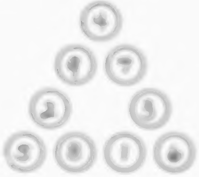
It is clear that what was learned from the previous problem similar to this is valuable in this more complex situation! Acquiring problem solving techniques that work in a broad range of applications helps us to better understand that "mathematics is the pursuit of laziness!" The type of reasoning employed up to this point is much less work than mere trial and error!

Let's try something new. If we arrange the numbers 1-9 and underline the numbres used in each instance we may gain a clue as to where to go next.

1 2 3 4 5 6 7 8 9 yielded the sum of 17 along each leg.
1 2 3 4 5 6 7 8 9 yielded the sum of 23 along each leg.

It appears from this pattern that using 4, 5, and 6 at the vertices might give us the middle number between 17 and 23. Let's test this conjecture.

45+4+5+6=60. 60 divided by 3 is 20, the middle number! This is heartening! let's test an arrangement with 4, 5, ans 6 at the verticies. We have a solution just as we hypothesized.



We can now add this pattern for solutions:
1 2 3 4 5 6 7 8 9

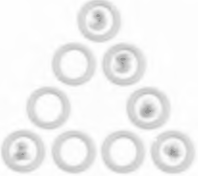
Next, we have to ask ourselves, "Are there solutions with the sums 18, 19, 21, and 22?" The road gets a little rougher at this point. Let's test for the sum of 18 first.

If we are to have a sum of 18, the total we divided by 3 must be 54. 54-45=9, which has to be the sum of the numbers used at the vertices. Let's list all of the possibilities in a systemmatic way:

1+2+6 1+3+5 2+3+4

Note that these are in an order which, if the plus signs were removed, would give us 126, 135, and 234.

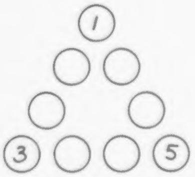
Of these candidates, there is something about using 2, 3, and 4 that seems to be promising. To obtain 18 along the side with 4 and 3 at the vertices, we need two numbers who sum is 11 since 11+4+3=18. What are the possibilities using any two of the remaining numbers? There is only one: 5+6. So, we place this sole possibility between 4 and 3.



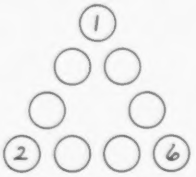
(continued on page 6)

Moving to the side with 4 and 2 at the verticies we need a sum of 12 since 12+4+2=18. What possibilities are there from the remaining numbers? We cannot use 2, 3, 4, 5, or 6 since they have already been placed into position. There are no two numbers remaining that total 12 and therefore there is no solution possible with 2, 3, and 4 at the vertices!

That's disappointing. But, we still have two options. Let's test another likely candidate: 1, 3, and 5. We need two numbers whose sum is 10 to go with 5 and 3 since 10+3+5=18. The candidates are 2+8, and 4+6. We will examine both cases.



Looking at the side bounded by 1 and 3, we note that we need two numbers whose sum is 18-(1+3) or 14. If we used 2 and 8 in the first case, we have no two numbers left whose sum is 14. Testing the second case we cannot use the numbers 1, 3, 4, 5, or 6. There are no two numbers left in this instance either. We have come to a dead end with 1, 3, and 5 at the vertices. Only one option remains: to use 1, 2, and 6.



Testing the side bounded by 1 and 6, we need two numbers whose sum is 11. The possibilities are: 3+8 and 4+7. Again, we start by setting up both cases.

We need two numbers who sum is 10 for the side bounded by 2 and 6. There are no two such numbers for the first case since 1, 2, 3, 6, and 8 are not available and so there is no solution with that approach. We are now down to our last alternative if there is to be a solution!

Using 4 and 7 on the side bounded by 1 and 6, we again need a pair of numbers whose sum is 10 for the side bounded by 2 and 6. There is no such pair!

There is no solution for this microworld where the sum along each side is 18! What a revolting development! It is clear that one of the triangle's secrets is that one or more sums between 17 and 23 have no solutions.

The reflection of 18 is 22, each of which is removed by one from one of the extreme numbers giving a solution. How do you rate the chances for a solution for 22? Try it!

A good problem solver must persist in the face of failure! So, we take new courage to move on.

Here we will direct our efforts toward finding a solution with the sum of 19. 3x19=57. 57-45=12. The sum of the numbers at the vertices must total 12. Listing all possible ways to get a sum of 12 we have:

1+2+9 1+4+7 2+3+7
1+3+8 1+5+6 2+4+6
3+4+5

There is something about using 3, 4, and 5 that is appealing since these numbers have a regular pattern.

The two numbers between 3 and 4 must have a sum of 12. There are no two numbers remaining with this sum. Let's try 2, 4, and 6.

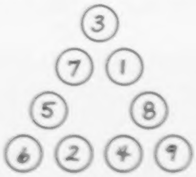
The two numbers between 2 and 4 must total 13. We have one pair of such numbers remaining: 5 and 8. Between 2 and 6 we need two numbers with the sum of 11. No such pair remains, so there is no solution using 2, 4, and 6 at the vertices. Only one set with a pattern remains: 1, 4, and 7. Let's test it.

Between 1 and 7 we need a sum of 11. 9+2, 8+3, and 6+5 are available. This is encouraging! Let's use 9 and 2 along with the 1 and 7. Between 4 and 7 we need a sum of 8. From the remaining numbers 3 +5 has not been used. We insert it between 4 and 7. We have only 6 and 8 remaining. Inserting them between 1 and 4 in the triangle we obtain the sum of 19. We have a solution! Do any of the remaining sets of numbers above provide a solution? We leave that for you to test.

Let's arrange our solutions according to the following pattern. We insert a sequence for the sum of 21 since that is the next object of our search.

$\underline{1\ 2\ 3}\ 4\ 5\ 6\ 7\ 8\ 9$	Sum of 17
$\underline{1}\ 2\ 3\ \underline{4}\ 5\ 6\ \underline{7}\ 8\ 9$	Sum of 19
$1\ 2\ 3\ \underline{4\ 5\ 6}\ 7\ 8\ 9$	Sum of 20
$1\ 2\ \underline{3}\ 4\ 5\ 6\ 7\ 8\ \underline{9}$	Sum of 21?
$1\ 2\ 3\ 4\ 5\ 6\ \underline{7\ 8\ 9}$	Sum of 23

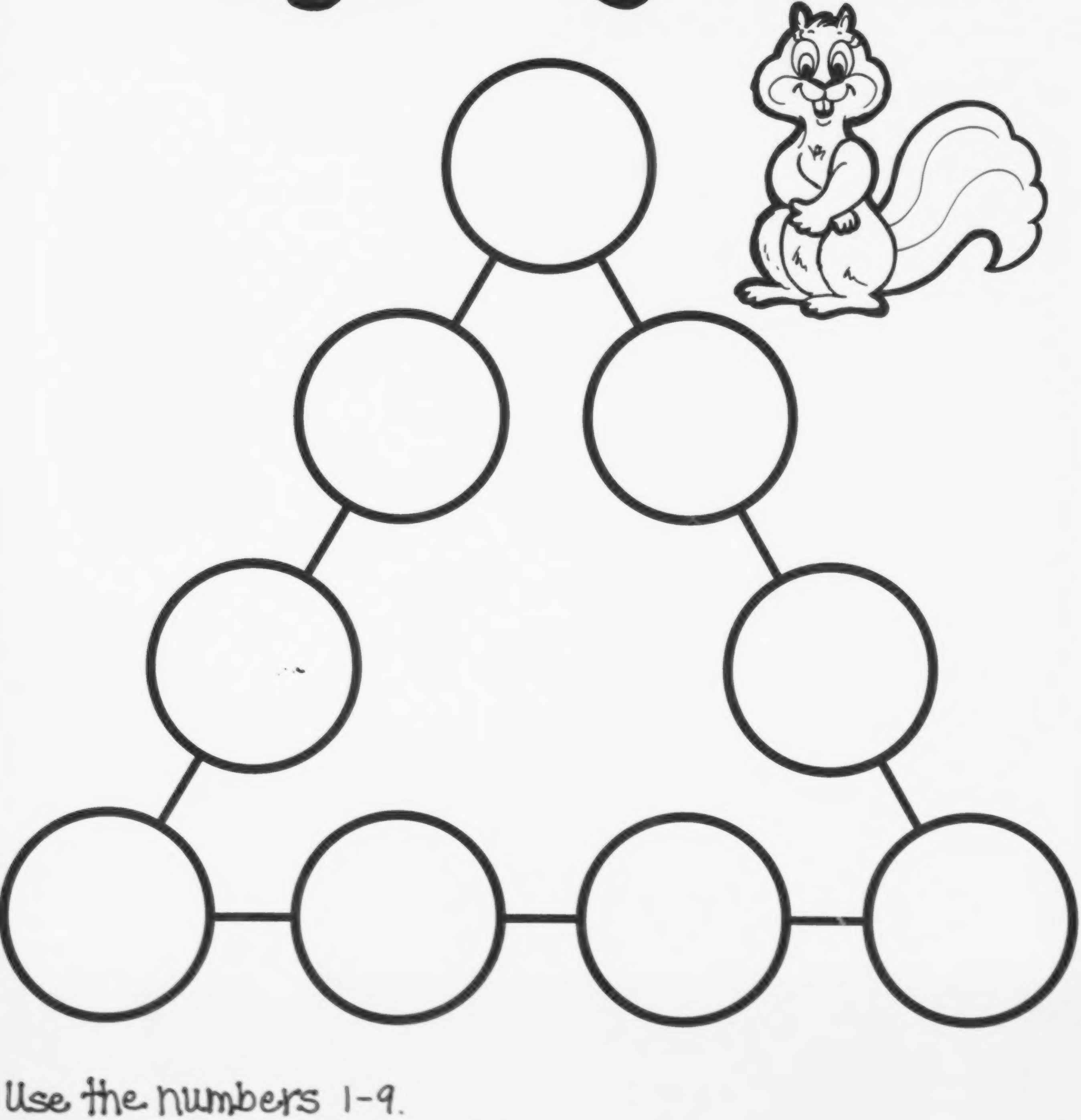
Looking at this table we notice a certain symmetry. The sums of 17 and 23 use numbers at the front and end of the line and the sum of 20 the numbers at the center. Is it reasonable to assume that a similar symmetry exists between the sums of 19 and 21? If so, the numbers 9, 6, and 3 should give a solution if used at the vertices. Let's test this conjecture.



Between 3 and 6 we need the sum of 12. 8+4 and 7+5 are possibilities. Using 7 and 5 with 3 and 6 we have a sum of 21. Between 9 and 6 we need a sum of 6. 2+4 is available. 9+2+4+6=21. The two remaining numbers are 1 and 8. Used between 3 and 9 they give a sum of 21 and we have a solution just as we conjectured!

The question remains: are there other solutions using other numbers at the vertices for the sums of 19, 20, and 21? We leave you with that question.

Triangle Mysteries



Use the numbers 1-9.
Arrange them so the sum
along each side is the same.
Find all possible sums.

Predictable Patterns

Make as many predictions in each case as there are spaces.

1. 1, 2, 4, 7, 11, 16, 22, 29, 37
2. 1, 3, 5, 7, 9, 11, 13, 15, 17
3. 3, 6, 9, 12, 15, 18, 21, 24
4. A, B, D, G, K, P, V
5. 1, 2, 4, 8, 16, 32, 64, 128
6. 1, 4, 3, 6, 5, 8, 7, 10, 9
7. 1, 3, 2, 4, 3, 5, 4, 6, 5
8. 3, 6, 12, 24, 48, 96, 192, 384
9. 4, 12, 8, 16, 12, 20, 16, 24, 20

*10. 3, 2, 6, 5, 15, 14, 42, 41, 123, 122

11. 3, 7, 12, 18, 25, 33, 42, 52, 63

*12. 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144

13. 1, 3, 6, 10, 15, 21, 28, 36, 45
14. 1, 4, 9, 16, 25, 36, 49, 64, 81

*15. 0, 3, 0, 4, 1, 6, 3, 9, 6, 13, 10

*16. 6, 11, 1, 3, 13, 18, 8, 10, 20, 25, 15, 17, 27, 32

*17. 1, 4, 9, 1, 6, 2, 5, 3, 6, 4, 9, 6, 4, 8, 1, 1, 0, 0, 1

*18. 1, 1, 4, 3, 9, 6, 16, 10, 25, 15, 36, 21, 49, 28

Mathematics Series, Set A

SOLUTIONS EXPLAINED

10. Subtract 1, multiply by 3. Repeat.
12. Add the two previous terms to get the next term. (This pattern is known as the Fibonacci sequence.)
15. Add 3, subtract 3, add 4, subtract 3, add 5, subtract 3, etc.
16. Add 5, subtract 10, add 2, add 10. Repeat.
17. Remove commas and discover the square numbers.
18. Square and triangular numbers alternate.

Predictable Patterns

Make as many predictions in each case as there are spaces.

1. 1, 2, 4, 7, 11, ____, ____, ____, ____
2. 1, 3, 5, 7, 9, ____, ____, ____, ____
3. 3, 6, 9, 12, ____, ____, ____, ____
4. A, B, D, G, ____, ____, ____, ____
5. 1, 2, 4, 8, ____, ____, ____, ____
6. 1, 4, 3, 6, 5, ____, ____, ____, ____
7. 1, 3, 2, 4, 3, ____, ____, ____, ____
8. 3, 6, 12, 24, ____, ____, ____, ____
9. 4, 12, 8, 16, 12, ____, ____, ____, ____
10. 3, 2, 6, 5, 15, 14, ____, ____, ____, ____
11. 3, 7, 12, 18, 25, ____, ____, ____, ____
12. 1, 1, 2, 3, 5, 8, 13, 21, ____, ____, ____, ____
13. 1, 3, 6, 10, 15, ____, ____, ____, ____
14. 1, 4, 9, 16, 25, ____, ____, ____, ____
15. 0, 3, 0, 4, 1, 6, 3, ____, ____, ____, ____
16. 6, 11, 1, 3, 13, 18, 8, 10, 20, 25, ____, ____, ____, ____
17. 1, 4, 9, 1, 6, 2, 5, 3, 6, 4, 9, 6, 4, 8, 1, ____, ____, ____, ____
18. 1, 1, 4, 3, 9, 6, 16, 10, 25, 15, ____, ____, ____, ____

SANDY MAGNET

GENERAL INFORMATION

Although no one knows for sure what causes magnetism, most scientists believe that it is caused by the way the molecules in the magnet are arranged. Every molecule has an attraction for other molecules. In a plain bar of iron the molecules are randomly arranged so their attraction for each other cancels out. In a magnetized bar the molecules are lined up in rows with their north poles pointing north and their south poles pointing south. They all pull as a unit and can attract metal objects outside the bar.

The first magnets were stones (loadstones) discovered in an ancient country of Asia Minor, called Magnesia. People were puzzled by the way the stones attracted metal and many believed magnets were "magic" stones. When a stone was hung from a string it turned until one end pointed north and the other end pointed south. This discovery led to the invention of the compass which enabled sailors to better navigate their ships because they could tell in which direction they were sailing, even in a storm.

Scientists believe that the formation of some iron ores began over a billion years ago. When great volcanoes spouted dust into the air it fell into streams and rivers. The water dissolved iron out of the rocks and carried the iron particles into the oceans. As the iron fell to the bottom along with sand and silt it formed layers on the bottom of the oceans. Heat and pressure compressed these layers to form rock.

Over millions of years, earthquakes and glaciers brought these layers of rocks to the surface and moved them to different areas. As the ice melted, rivers formed and cut grooves in the rocks, transforming them to gravel and sand which was deposited over the surface of the earth. Today we can move a magnet through dirt and sand and the iron molecules that were formed millions of year ago will be attracted to it.

MATERIALS

A small magnet can be purchased at a hardware store for about 25¢. Collect about ½ cup of dry dirt or sand from the yard or playground. Use a large steel nail—do not use a nail made of aluminum.

PROCEDURE

Follow procedures 1-5 as indicated on the activity sheet. If you have enough magnets have the students take one home and collect iron particles from the dirt around their house. Provide a container so the iron attracted by the magnet can be stored for other experiments.

POSSIBLE ANSWERS TO QUESTIONS

1. After the nail was moved through the sand it had some dust and sand clinging to it. This was probably removed when it was immersed in the water.
2. When the magnet was moved back and forth in the sand, iron particles were attracted to it.
3. When the magnet was immersed in the water the dirt washed away and the iron was held to the magnet.
4. The "stuff" (iron particles) came from the iron ore that formed in the earth billions of years ago and was carried to all parts of the earth by a combination of volcanoes, earthquakes, and glaciers.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

1. Use the information given in "General Information" to indicate what scientists believe happened to make the dirt and sand contain iron particles.
2. Have students list the many ways that they might observe magnets being used around the home.
3. Use a world map to find out where Magnesia was located in Asia Minor.
4. Make the nail a temporary magnet by stroking it about 50 times with the magnet (stroke in same direction, not back and forth). Move the nail in the sand to see if it will now attract the iron particles.

Sandy Magnet

Materials:

- 2 paper or plastic cups
- sand
- magnet
- nail
- water
- paper

Procedure:

1. Move the nail back and forth through the sand and then dip it into the cup of water.
2. Move the magnet through the sand. Feel the magnet and determine if there is something clinging to it.
3. Dip the magnet into the cup of water.
4. Sprinkle some sand onto a piece of paper. Slowly move the magnet across the sand about 1" above the paper.
5. Scrape the particles clinging to the magnet onto a clean piece of paper.

Questions:

1. What happened when the nail was moved through the sand and then dipped into the water?
2. What happened when the magnet was moved through the sand?
3. Did anything unusual happen when the magnet was dipped into the water?
4. Where did the "stuff" on the magnet come from?

Bear Logic

I. Topic Area
Logic and problem solving

II. Introductory Statement
Students will use Teddy Bear counters and logical thinking skills to solve situational problems.

III. Math Skills
- a. Logical thinking
- b. Sequencing
- c. Problem solving
- d. Inferring

Science Processes
- a. Comparing
- b. Organizing & recording data
- c. Inductive & deductive reasoning
- d. Drawing conclusions

IV. Materials
Teddy Bear counters or pictures of Teddy Bear counters
Crayons or colored pencils

V. Key Question
Which bear lives in which cave? (Key question will vary with each logic problem.)

VI. Background Information

Youngsters in the early grades should have many opportunities to make reasonable or logical conjectures about situations with concrete materials. Every child should be involved in hands-on activities that allow him to verbalize and describe or act out the situation described (the problem). Through discussion and careful questioning on the part of the teacher, students may see relationships, implications, and make observations, generalizations, predictions, and interpretations.

Students may use Teddy Bear counters or pictures of Teddy Bears to assist in solving the problems. A bear is placed in each and every square in the grid. Removing bears from the grid is a way of recording a "no" response to a given clue. Bears left in position at the end of the problem indicates a "yes" response. Only one bear should remain in each row and column.

The questions posed in this manuscript are general in nature and may be appropriate for all of the logic problems in this series. It is important that teachers re-form the questions to be more specific for each activity. For instance, in the Bear Caves problem, what does the clue that states Bonnie does not live in Creaky Cave tell us? What does that clue tell us about Bobby or Burt? These question are more specific to the problem. In the manuscript the questions are generic, i.e., What does a clue with the word "not" in it tell us?

VII. Management Suggestions
1. This activity may take up to 30-40 minutes.
2. Students may work in pairs or small groups. First time simple logic problems may require a highly structured teacher directed experience.
3. Overhead projector and a transparency of the problem and grid may be helpful when discussing questions and possible situations.
4. If Teddy Bear counters are unavailable, use pictures of Teddy Bears and have youngsters cut out one bear for each square on the grid.

VIII. Procedure
1. Distribute activity page and Teddy Bear counters or pictures to each group.
2. Place one Teddy Bear counter or picture in each space on the grid. All bears in a single row represents the named bear on the left. For instance, in Bear Caves the top row of bears represents Bonnie Bear.
3. Read the situation together.
4. Have one student in each group re-tell the situation or problem to his group.
5. Discuss each clue with the students and the information it provides.
6. Remove bears as appropriate.
7. Record conclusions

IX. Discussion Questions
1. What does a sentence or clue with the word "not" tell you? If "not" tells you that something is not true, how might it also tell you something that is true?
2. What kinds of words signal a "yes" response?
3. What kinds of words signal a "no" response?
4. After discovering a "yes" response, how does that affect the remaining choices in the row in the column? in the rest of the grid?

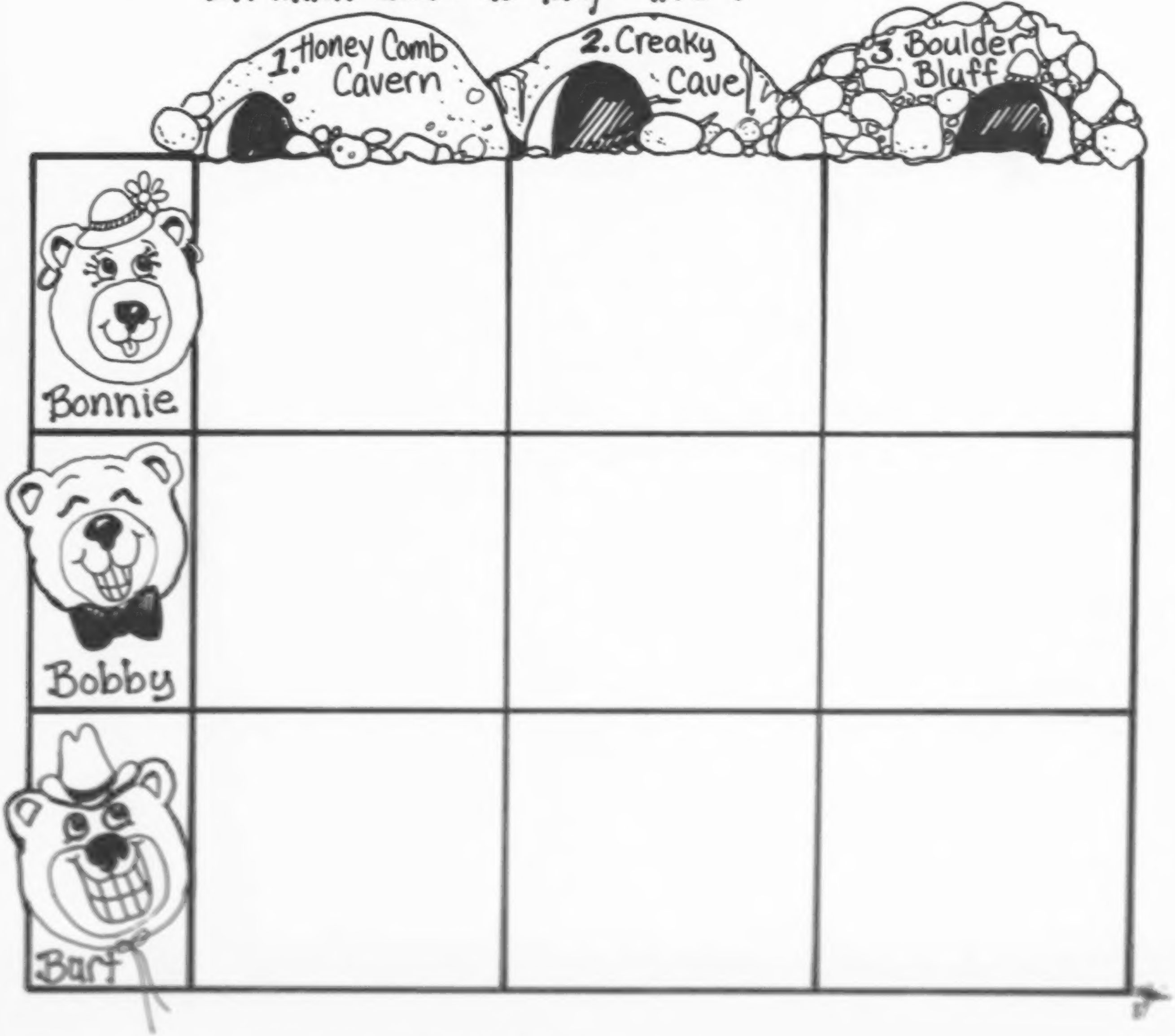
X. Extended Activities
Read Goldilocks and the Three Bears, Paddington Bear and Winnie the Pooh. Write appropriate inquiries as a group experience.

Bear Caves

______________ Name

1. Bonnie, Bobby, and Burt all live in different caves.
2. Bonnie does not live in Creaky Cave.
3. Bobby does not live in Boulder Bluff.
4. Burt lives between Bonnie and Bobby.

In which caves do they live?

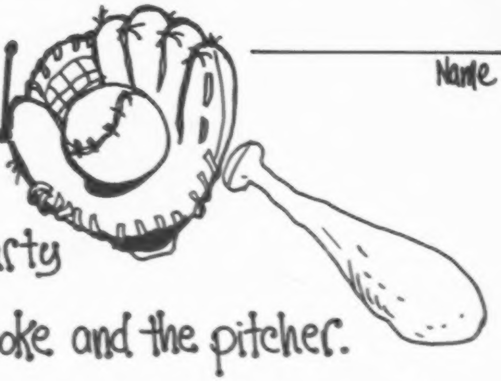


Bonnie Bear lives in ______________.

Bobby Bear lives in ______________.

Burt Bear lives in ______________.

Bear Baseball



____
Name

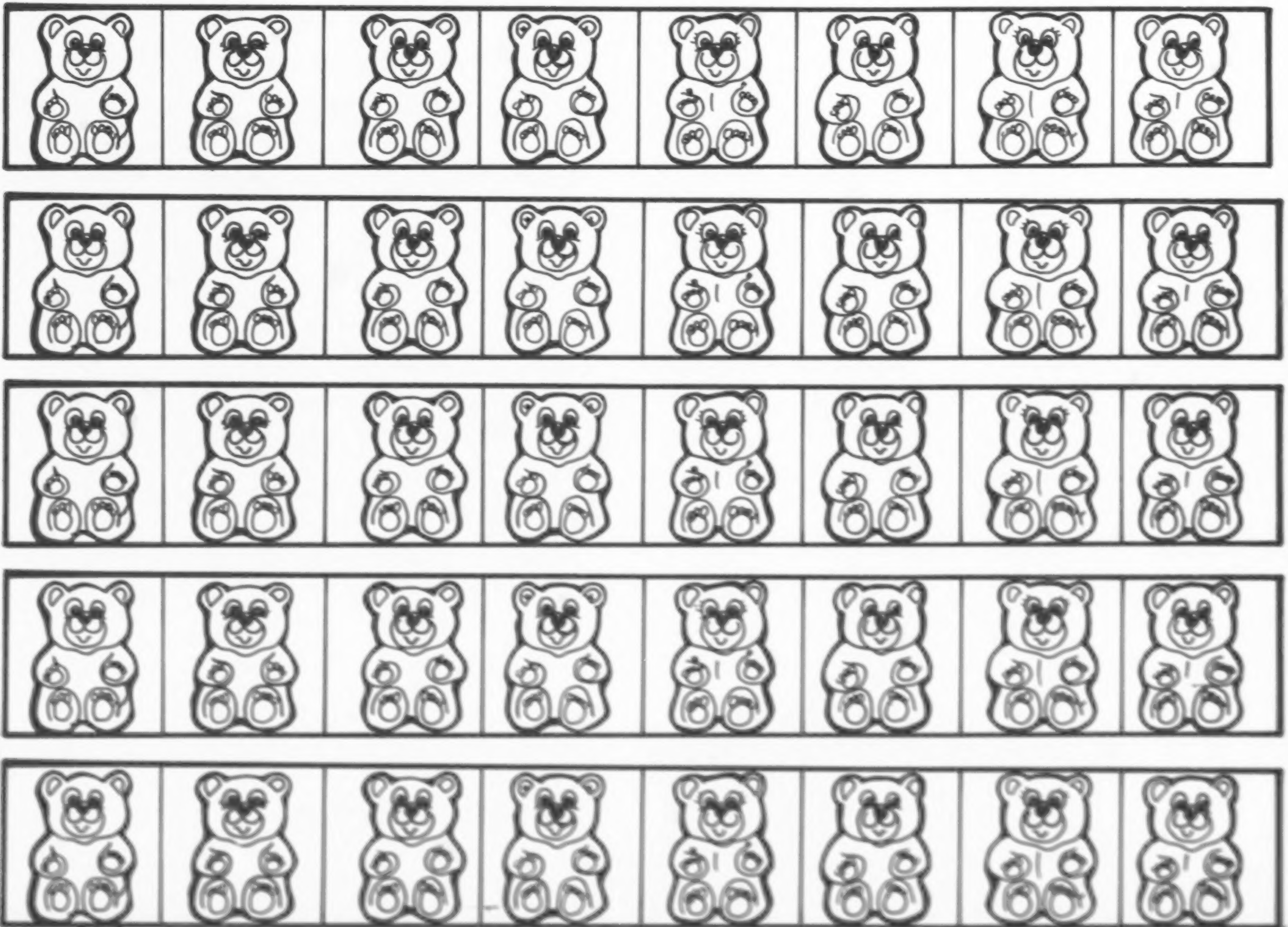
1. Buddy and the shortstop gave a party for Bobo yesterday.
2. Bobo sent thank you notes to Brooke and the pitcher.
3. Buddy is not the catcher.
4. Who plays each position?

	Catcher	Pitcher	Shortstop
 Buddy			
 Bobo			
 Brooke			

Buddy Bear is the______________.

Bobo Bear is the______________.

Brooke Bear is the______________.



THE LEAFY FACTS

(Part I)

I. Topic Area

Leaves

II. Introductory Statement

Students will learn the differences between simple and compound leaves and identify parts of a leaf.

III. Math Skills

a. Measuring
b. Logical thinking
c. Problem solving
d. Charting
e. Graphing

Science Processes

a. Observing
b. Compare and contrast
c. Draw conclusions

IV. Materials

Leafy Facts and More Leafy Facts sheets
Leaves (an assortment)
Centimeter rulers

V. Key Questions

Do all leaves have the same characteristics?
What characteristics are common to all leaves?

VI. Background Information

The sudents will need copies of the Leafy Facts and the Leafy Facts (worksheet No. 1). Students can bring the leaves from home, or the teacher can. This activity would work best if there were several different types of leaves to show the difference between simple and compound. This activity should take approximately two 45 minute periods.

Procedure

VII.

1. Read and discuss the Leaf Facts sheet aloud with the class. It is important to do this first so the students will bring in the whole stem on compound leaves.
2. Discuss the different parts of a leaf.
3. Give every student a leaf to observe.
4. Place the leaf on Worksheet No. 1 and trace around the leaf carefully.
5. Measure the leaf's length, width, and area. A leaf is not a regular polygon and cannot be measured by the formula (l x w) = a. Therefore, the area for the leaf can be found by taking the average length times the average width or by counting the number of squares.
6. Circle the type of leaf (simple or compound).
7. Students may fill in the vein structure of their leaf.
8. Students may also color the outlined leaf.
9. Students need to share and compare their leaves to other leaves in the class.

VIII. What the students will do

1. Learn the differences between simple and compound leaf structures.
2. Learn the parts of a leaf.
3. Bring leaves from home if requested by the teacher
4. Measure, label, and draw their leaves (worksheet No. 1).
5. Discuss their observations of leaves in class.

IX. Discussion

1. What characteristics were common to all the leaves?
2. How is the vein system different or the same in leaves?
3. How can a leaf tell us the type of plant it came from?

X. Extension

1. Let each student do two worksheets. One for a simple leaf and one for a compound leaf, so they can see the differences.
2. Creative writing.
3. Leaf prints.
4. An art project pressing the leaves between sheets of wax paper and ironing the sheets.
5. Haiku poetry about leaves
6. Make a graph showing how many simple leaves were found in comparison to compound leaves.
7. Leaf rubbings.

T.V. Adventure continued...

IX. Discussion

1. Were class predictions higher or lower on the number of ads?
2. At which times are more food ads presented?
3. Are alcohol/drug ads a significant part of TV time?
4. Can a consistent pattern of ad presentation be found throughout a week or evening of TV?
5. Is there a peak hour when more ads are presented?

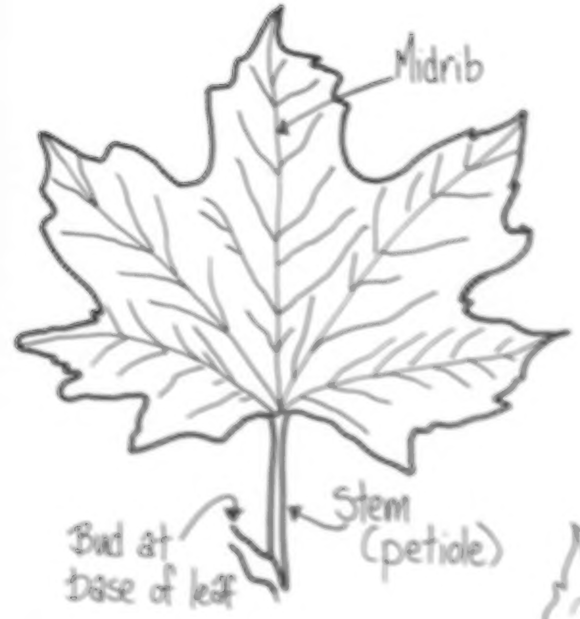
X. Extensions

1. Complete "Watch What You Eat".
2. Compile data from all the teams and draw bar/line graphs to illustrate the results of one week of watching.
3. Change viewing hours to late afternoon, early morning, etc., and compare type and quantity of ads.
4. Survey ads on a Saturday morning, a major sporting event or a soap opera to determine how types of ads vary according to the audience.
5. Do an actual time study and determine how much of an hour is viewing and how much is ads. Find the average length of an ad.

XI. Curriculum Coordinates

Language-write letters to TV stations to find out advertising rates.

Leafy Facts

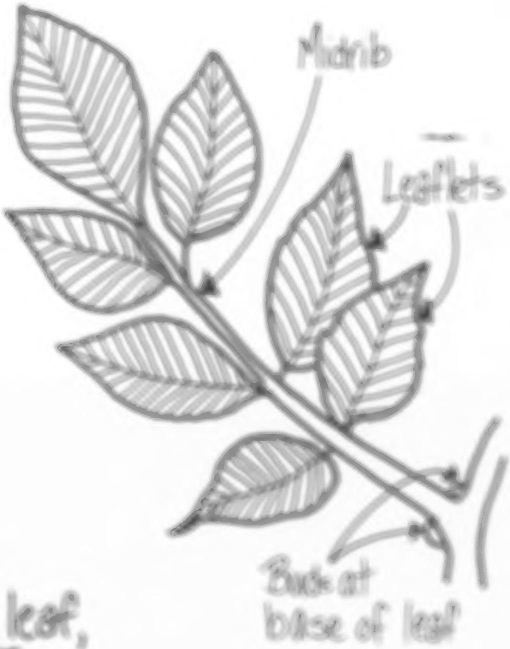


Simple Leaf

The broad, flat part of a leaf is called the blade. The blade is connected to the stem or petiole. The stem supports the blade and turns it towards the sun. The bud grows at the base of the leaf. The midrib is the central stalk of the leaf.

Compound Leaf

In some plants, the blades are divided into a number of small leaves called leaflets. A compound leaf has a number of leaves arranged in two rows facing each other along the midrib. One leaflet may grow at the tip of the midrib of some compound leaves. Buds always appear at the base of the leaf, never at the base of the leaflets.



Name of Botanist: ____________

The Leafy Facts

Leaf type: simple
compound

Describe the color and shape of your leaf:

____

____

Trace your leaf onto the grid. Label the parts of your leaf. Draw in the vein structure.

Measure and count.

Leaf length: ________ cm

Leaf width: ________ cm

Leaf area: ________ cm²

Trace your leaf here

THE LEAFY FACTS

(Part II)

I. Topic Area

Leaf classification

II. Introductory Statement

Students will classify a group of leaves into five different groups according to their classification.

III. Math Skills	**Science Processes**
a. Logical thinking	a. Observing
b. Sorting	b. Comparing & contrasting
c. Problem solving	c. Classifying
d. Graphing	d. Colleting data
e. Percentage	e. Recording data
	f. Drawing conclusions
	g. Predicting

IV. Materials

The Leafy Facts and More Leafy Facts sheets
Leaves
Transparency of worksheet (teacher choice)

V. Key Questions

Given a group of leaves can we classify them according to specific characteristics? Which type of leaf will the students find the highest percentage of in their neighborhood or schoolyard?

VI. Background Information

The scientific classification of leaves is very broad and difficult. This activity is a condensed version so that the students can participate and understand classification. The Fact Sheet gives the teacher and the student the information needed to identify the characteristics given on The Sorting Tree (worksheet No. 2).

VII. Management Suggestions

1. On the first day of this activity the teacher and students should read and discuss The Leafy Fact sheet. One 45-60 minute period. The teacher may want to bring in a sample of each type of leaf mentioned on The Sorting Tree worksheet.
2. Students should then predict which leaf type will have the higest percentage in their neighborhood or schoolyard.
3. Students should collect leaves that night from their home or neighborhood keeping in mind the different types they had learned about that day. It is important students bring in one leaf from each plant found.
4. Students can also take another period and take a field trip around the school to collect leaves.
5. Divide students into groups of 5 or 6. They can put all their leaves together in one group.
6. The sorting and data collecting will take approximately one 60 minute period.

VIII. Procedure

1. Introduce the fact sheet called The Leafy Facts.
2. Have students predict which leaf type will have the highest percentage in their neighborhood or schoolyard.
3. Students collect leaves at home or at school and combine them with others in their group.
4. On the desk top have students sort their groups of leaves into two groups: needlelike and broad leaves.
5. Sort needlelike group into two groups: single needle and other than single needle. That will finish the needlelike classification.
6. From the broad leaf group divide into two groups: Parallel veined and all other leaves into the branched or webbed group.
7. From the branched or webbed group divide into Pinnate (featherlike) and Palmate (fanlike).
8. Write the number of leaves found in each of the groups of The Sorting Tree worksheet.
9. Students will then complete the data chart and construct a bar graph showing the results of their findings.

IX. What student will do

1. Predict which type of leaf they find the highest percentage of in their neighborhood or schoolyard.
2. Collect leaves either at home or at their school.
3. Sort leaves by given classifications following instructions given by the teacher.
4. Fill in The Sorting Tree.
5. Record number, ratio, and percent of each leaf type.
6. Make a bar graph of leaf types showing percent of each.

X. Discussion

1. What type of leaf was found in the highest percentage?
2. What type of leaf was the lowest percentage?
3. Did you predict correctly?
4. What was your reasoning?
5. Does the environment have anything to do with the kind of leaves found in any neighborhood?

XI. Extensions

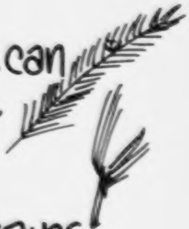
1. Discuss other differences in leaves such as simple or compound, leaf arrangement on stem, and leaf margins.
2. Discuss the function of a leaf on a plant.
3. Discus photosynthesis.
4. Creative writing.
5. Leaf prints.
6. Make a class graph showing each group's results.
7. Leaf rubbings.
8. Make a bulletin board of The Sorting Trees only larger, put large ziplock baggies in each tree, and place each group's leaves in the appropriate bags.
9. Use the bulletin board as a learning center and place leaves in a sorting bag and students must sort according to characteristics.
10. See Leaf Scavenger Hunt.

More Leafy Facts

A blade of grass, a pine needle, a fern frond, and a maple leaf are all leaves. Most leaves need light ☼ air ☁, and water 💧. Leaves contain green cells to make food for the entire plant.

Leaves look very different, however. Every plant has its own distinctive kind of leaf. Leaves help us identify plants like fingerprints identify people.

Needle like leaves can be divided into two groups. Needles can be attached singley to a stem. Other needlelike leaves have needles attached in bundles of two, three, and four.



Almost all other leaves can be grouped into broad leaves. Broad leaves can be further classified by their pattern of veins.

In palms, grasses, and other plants, the veins run parallel to one another from the petiole to blade tip.

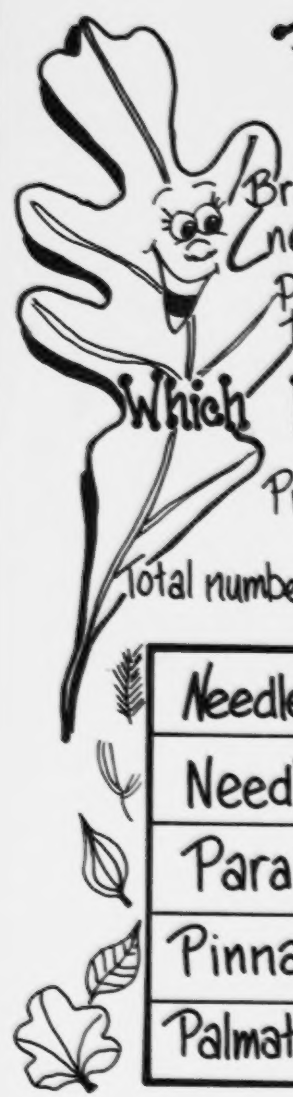
The branched or webbed group can be classified into 2 groups- pinnate (featherlike) or palmate (fanlike.

In the pinnate group, the veins branch out from the midrib like barbs of a feather.

The veins in a palmate leaf fan out from the petiole and form a network of smaller veins through the leaf.

Name: ______________________
Botanist

The Leafy Facts



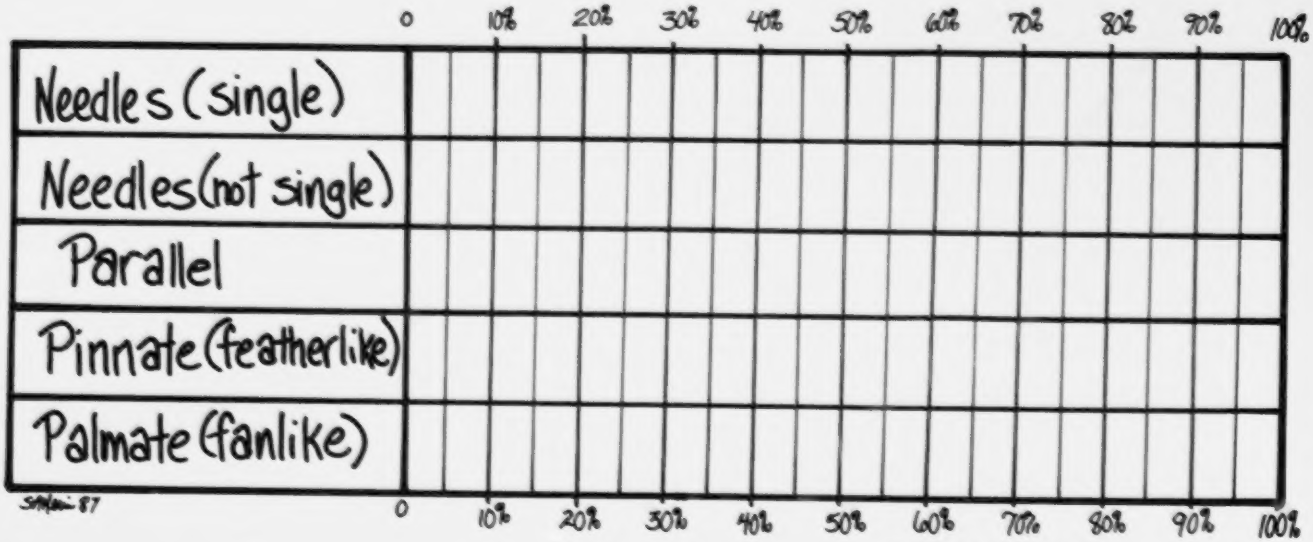
Bring in a collection of leaves from your schoolyard or neighborhood. Sort into categories. Count, then compute the percentages for each leaf type. Construct a bar graph to display the data.

Which leaf type will be the highest percentage?

Prediction: _____ Actual: _____

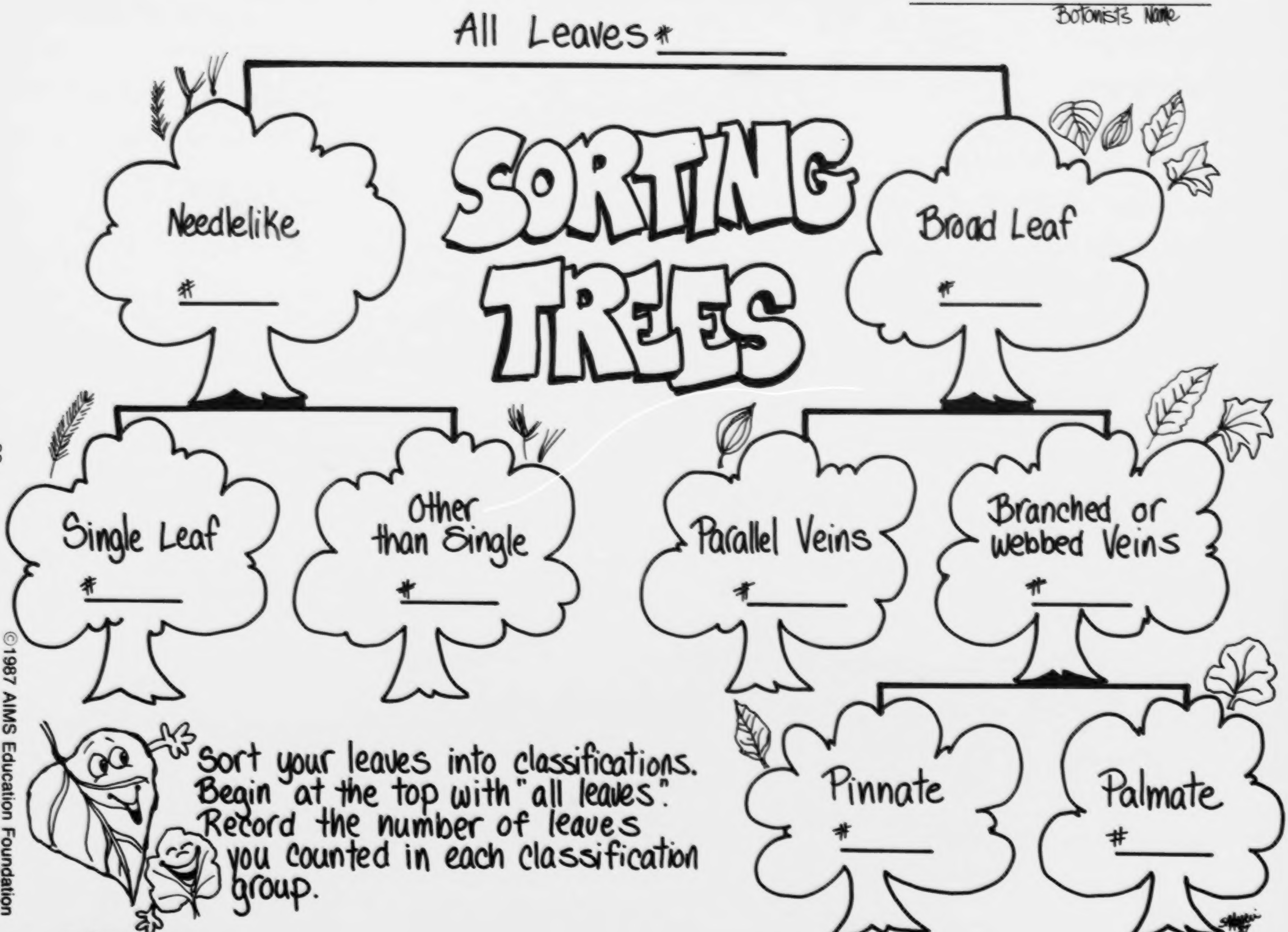
Total number of leaves ☐

	# of leaves in group	Ratio # of leaves / total	Percent of leaves
Needles (single)			%
Needles (not single)			%
Parallel			%
Pinnate (featherlike)			%
Palmate (fanlike)			%



____
Botonist's Name

SORTING TREES



Sort your leaves into classifications. Begin at the top with "all leaves." Record the number of leaves you counted in each classification group.

T.V. ADVENTURE

I. Topic Area
Probability and statistics

II. Introductory Statement
In this investigation, students will watch TV for a specific amount of time and record the number of ads seen. After gathering the data, they will determine the average number of specific ads/hour. Students will then make a circle graph showing their results.

III. Math Skills	Science Processes
a. Adding	a. Predicting
b. Dividing	b. Observing
c. Averaging	c. Classifying
d. Percentage	d. Collecting & recording data
e. Rounding off	e. Analyze date
f. Graphing	

IV. Materials
Student worksheets
Protractors
TV Time
Calculators

V. Key Question
What is the average number of ads/hour on TV?

VI. Teacher Background

The average adult American spends almost 4½ hours each day watching TV... an increase of 81% in the past 15 years. Future generations are well on the way to developing tube addiction. Today's children spend about the same amount of time watching TV as adults. By the time a student finishes high school, he/she will have put in 22,000 hours before the tube--about twice the time they'll have spent in the classroom. TV time is saturated with ads directly influencing the consumer on what he wears, buys, and eats.

Students need a good understanding of how to cmpute averages and percentage to complete the investigation.

$$\text{Percentage} = \frac{\text{type of ad/hour}}{\text{total ads/hour}}$$

Calculators may be used to compute percentages/averages depending on the ability level of the students involved.

Students need to understand the process of making a circle graph. To make a circle graph showing 35°, center your protractor on the dot of the circle. Align the zero° with the drawn radius. Place a mark at 35°. Draw the radius connecting the mark with the center dot. Use this line as zero° for your next section. Repeat the process until the graph is completed.

VII. Management Suggestions
Each student will have their own worksheet. Students will be divided into survey teams to split up the TV time. Each team will watch a different day. In case of duplicate days, different stations will be watched. Cable stations will not be used due to the lack of ads. Calculators may be used at the discretion of the teacher.

VIII. Procedure

This investigation will take one week, but only involve 2 class sessions. In the introductry class sesion, the teacher will initiate a class discussion on the viewing of TV. An informal (oral) survey may be taken on the number of hours students watch TV. This discussion should take the direction of consumer awareness and what influences our buying and eating habits.

Student worksheets will be passed out and each student will make their prediction on the **average** amount of ads/hour on TV. This prediction will then be broken down into food (either selling/showing food), alcohol/drugs, other TV shows, cars, and all other ads.

Students will then be divided into survey teams (either 2 or 4/team) for each day of the week. Days/stations will be chosen so there will be no repetition of data. Each group will decide how to divide up their time.

In the second class session, one week later, students will meet in their survey teams to exchange data and compile resutls. Students will then compute the averages (rounding off to the nearest whole ad) and compare this with their predictions. This data will be entered in the first chart. Percentages will also be commputed and will be entered on the first chart and then transferred to the chart on the second page.

Each student will then complete their own circle graph according to the actual percentages computed from the survey (the percentage x 360° will give the actual amount of degrees per section on the graph). Students will use protractors to complete their graph.

Class discussion will then be held regarding the results.

(continued on page 16)

T.V. AD-VENTURE

NAME OF VIEWER: ____________________

DAY WATCHED: ____________________

NAME of STATION : ____________________

I. Average Amount of Ads Per Hour

	Prediction	Actual	Percentage
FOOD:			
ALCOHOL/DRUGS:			
T.V. SHOWS:			
CARS:			
OTHER:			
ALL ADS TOTAL:			

Test Your Predictions:

1. Make a tally of the number and type of ads you see per hour. Gather data from other members of your group or class. Enter data in Chart II. Find totals of ads per hour and type of ads over the 3 hour period.

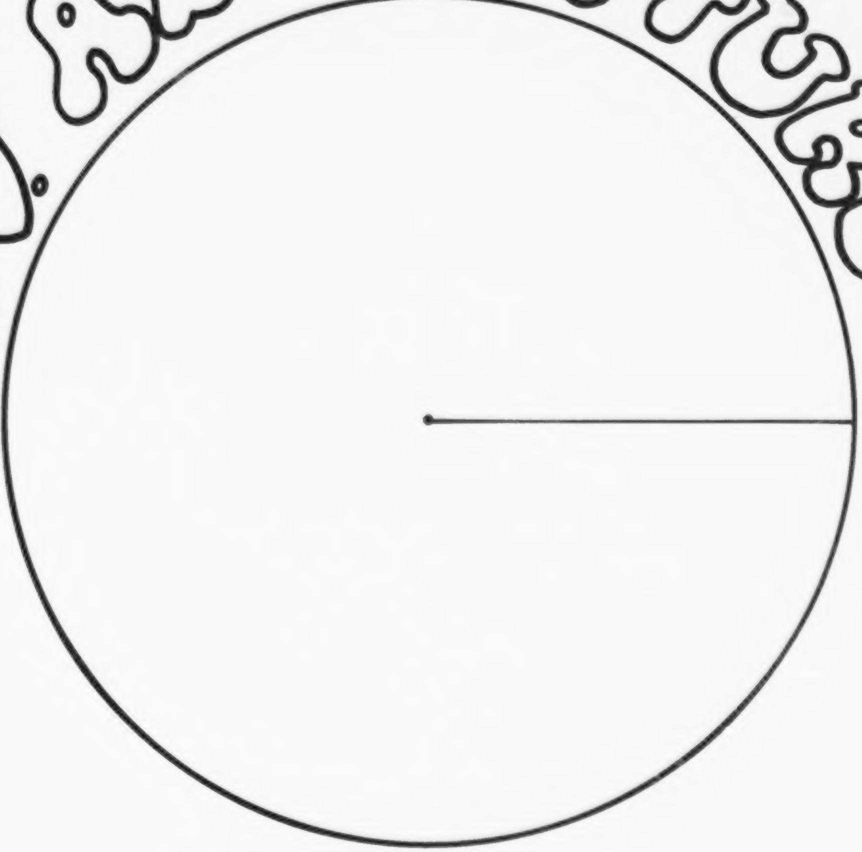
II.

TIME OF DAY	FOOD	ALCOHOL/ DRUGS	T.V. SHOWS	CARS	ALL OTHERS	TOTAL # ADS
6:00 PM – 7:00 PM						
7:00 PM – 8:00 PM						
8:00 PM – 9:00 PM						
TOTALS hours						

2. Compute the average amount of each ad/hour and enter into Chart I.
3. Compute the percentage for each type of ad; transfer this information to Chart III on the following page.

Viewer

T.V. AD-VENTURE



1. Take the actual percentages from your survey (CHART I) to compute the degrees for each section.
2. Use a protractor to complete the circle graph.

AD:	%		DEGREES
FOOD		x 360°	
ALCOHOL/DRUGS		x 360°	
T.V. SHOWS		x 360°	
CARS		x 360°	
OTHER		x 360°	

Watch What You Eat!

I. **Topic Area**

Probability and statistics

II. **Introductory Statement**

Students will gather data from classmate surveys and determine the probability of seeing a food ad during the evening viewing hours. The data will come from a time period of one week.

III. **Math Skills**

a. Adding
b. Approximation
c. Rounding off
d. Reducing fractions
e. Percentage
f. Decimals
g. Computing probability
h. Using calculators

Science Skills

a. Collecting & recording data
b. Comparing
c. Interpreting data
e. Identifying & controlling variables

IV. **Materials**

Student worksheet
Pencil
Data from Ad Attack
Calculators

V. **Background Information**

Being overweight is one of the top health problems in our country. The TV is a predominant factor in influencing our eating habits and encouraging us to eat more often by presenting us with a constant barrage of food commercials. We are asked, "aren't you hungry?" and then are shown a large amount of delicious looking food, which may not be very healthy for us. Results of a survey of 4 hours of TV will show how many food ads are constantly being seen.

Students also need to understand how to reduce fractions and round them off. Using calculators, students should be able to convert fractions to decimals and round them off to 2 places. Conversion of decimals to percentage needs to be known also.

VI. **Key Question**

"What is the probability of seeing a food commercial during the evening hours?"

VII. **Management Suggestions**

1. Approximately 1-1½ class sessions will be needed to tabulate the results and compute the probabilities. Students should have calculators available for the many computations.
2. After gathering data from six other individuals/groups, students should work independently.
3. Sample problems on the board/overhead projector showing a fraction being rounded off, changed to a decimal and then to a percent will greatly help the students with their work.

VIII. **Procedure**

1. Students will transfer their own results from "Ad Attack" for one of the columns on the top chart. They will then need to gather data from 6 other classmates/groups to complete the first chart.
2. Calculators should be distributed at this point so that the students can complete the totals.
3. The teacher may choose to demonstrate at this point how to complete the bottom charts by taking one example from a student and showing how to compute the various probabilities on the board or overhead projector.
4. Students will need to compute the probabilities of the food ads for each time period plus the overall probabilities for the 4 hours. Students will also compute the probabilities on a daily basis.
5. The key question will then be discussed and general conclusions drawn from students in the class.

IX. **Discussion**

1. Are we being heavily influenced by the ads we see on TV in relation to our eating habits?
2. How is TV contributing to the "overweight" problem in America?
3. Can we generalize and state specific times when there is a heavy preponderance of food commercials?

X. **Extended Activities**

1. Graphs can be drawn to illustrate results of the seven samples.
2. Daytime TV can be surveyed to see if the probabilities are the same.
3. Letters can be sent to TV stations encouraging the promotion of healthy food ads and less junk food ads.
4. Students can be taught consumer awareness and become very conscious of heavily prejudiced ads which promote foods that aren't especially nutritious.

Watch What You Eat!

______________________ Viewer

	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Totals	
	Food	All	Food	All	Food	All	Food	All	Food	All	Food	All	Food	All	Food	All
6:00 P.M. – 7:00 P.M.																
7:00 P.M. – 8:00 P.M.																
8:00 P.M. – 9:00 P.M.																
9:00 P.M. – 10:00 P.M.																
6:00 – 10:00 P.M. Totals																

What is the probability of seeing a food ad?

$$P = \frac{\#\text{ of food ads}}{\text{total }\#\text{ of ads}}$$

	Actual Fraction	Rounded Fraction	Decimal	Percent
6-7:00 P.M.				
7-8:00 P.M.				
8-9:00 P.M.				
9-10:00 P.M.				
6-10:00 P.M.				

(EVENING)

	Actual Fraction	Rounded Fraction	Decimal	Percent
Sunday				
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				

(DAILY)

Fresno Pacific Math-Science Project announces the

1987 Computer Courses

One and Two Week Courses Offered From June 15 to August 7

Major Course Features That Make the Fresno Pacific College Computer Courses Unique

- EXCELLENT FACULTY with extensive Grades 1-12 and college level computer usage and programming experience
- WELL-EQUIPPED COMPUTER LABS providing each participant sole use of a computer during all hands-on sessions
- A MINIMUM FIVE HOURS OF HANDS-ON INSTRUCTION plus two hours of hands-on practice time available daily
- DAILY OFF-COMPUTER PROGRAMMING SESSIONS where programming problems and solutions are discussed
- LOGO, PASCAL, and BASIC courses at both the beginning and intermediate levels during the summer
- INTRODUCTION TO PROJECT SETUP materials and instructional approach, exploring these innovative problem-solving experiences
- OPPORTUNITY to work and exchange ideas with scores of teachers from many parts of the nation and schools abroad
- SOFTWARE EVALUATION OPPORTUNITIES during which commercial, public domain, and teacher or student produced programs will be available
- INTRODUCTION TO LOGO PROGRAMS covering standard topics in geometry that have been classroom-tested for effectiveness
- WAYS OF USING THE COMPUTER AS A TOOL for word processing, databases and spreadsheets. Practical examples for putting out reports, lists of information and doing calculations
- THE BEAUTIFUL SMALL COLLEGE SETTING featuring air-conditioned classrooms and residence halls plus excellent food service that annually wins the praise of participants

The Fresno Pacific College Computer Courses have widespread recognition for their extensive and well-planned offerings in programming, applications, software evaluation and utilization, and discussion of crucial issues in computer education. The classes draw participation from all parts of California, other states and schools overseas. Master's candidates in computer education come from more than a half dozen states and abroad.

The 1987 Computer Courses feature an expanded program in areas of applications and software selection and utilization. Particularly significant is the addition of new SETUP (Software Evaluation and Teaching Utilities Project) materials in which participants will share in the rich contributions of that project.

Participants with no, little, or much experience with computers will find suitable offerings.

Features of the Computer Courses

The Computer Courses offer a unique, intensive, five-or ten-day experience at an unusually moderate cost! Of special significance is the fact that each participant will have the exclusive use of a computer for fifty hours of "hands-on" instruction during a two week class plus a generous amount of practice time, (up to forty hours). The computer faculty has placed primary emphasis on sound educational applications of computer technology in developing the program. The extensive classroom utilization experience of the faculty assures the validity and relevance of each element.

The Institute will offer sessions for software evaluation in curricular areas of the participants. There will be sharing of evaluations so all will benefit from each one's work. Special topic presentations dealing with issues and practices in computer education will occur during the evening programs.

Participants who have never touched a computer will quickly establish a friendly and lasting relationship with computers during their courses.

Elementary teachers should consider LOGO as a first programming language. LOGO is an ideal language to introduce students to programming and is designed to help students think logically. As such, it is the most immediately useful language for students in elementary schools. It has extensive usefulness for teaching geometry concepts.

High school teachers should give serious consideration to PASCAL as an ideal language for teaching all the advanced concepts for good programming and problem solving. It has many strengths not found in BASIC and other languages and is the required language for the College Boards Advanced Placement Exam.

For those interested in applications, courses are available in word processing with applications, spreadsheets (for calculations), data base management (for working with lists of data), and in their integration.

For those interested primarily in using computers to provide instruction, the SETUP strand is the logical choice. It requires no programming knowledge. SETUP is a Fresno Pacific project that is providing national leadership in the careful selection and intelligent and effective use of computer software.

DATE	COURSES	G	I-S	U*
June 15-19	Teacher Utilities Workshop		X	2
	Word Processing I	X	X	2
	Math/Science Software Workshop		X	2
June 22-26	FrEdWriter Applications Workshop		X	2
June 22-July 3	Beginning BASIC Programming	X	X	3
	Electronic Spreadsheets	X	X	3
June 29-July 3	Problem Solving Software Workshop		X	2
July 6-18	**Computer Institute**			
	Introduction to Using Computers	X	X	4
	Beginning LOGO Programming	X	X	4
	Beginning PASCAL Programming	X	X	4
	Intermediate BASIC Programming	X	X	4
	Word Processing II	X	X	4
	Integrated Systems I	X	X	4
	Evaluation & Integration of Software	X	X	4
July 20-24	Language Arts Software Workshop		X	2
July 20-31	Database Management	X	X	3
	Intermediate PASCAL Programming	X	X	3
July 27-Aug. 7	Intermediate LOGO Programming	X	X	3
August 3-7	Project SETUP Software Workshop		X	2
	LOGO Writer		X	2

*G = Graduate Credit; I-S = In-Service Credit; U = Units of Credit

ADDITIONAL INFORMATION FORM AND 1987 COMPUTER COURSES PRE-REGISTRATION

ALL information requested below must be supplied before this pre-registration can be processed. Full registration and housing information will be mailed upon such acceptance.

Name ______________________ Soc. Sec. No. ______________

Street ______________________ City ______________

State ______________ Zip ______________ Home Phone (______) ______________

School ______________________ Grade Level Assignment ______________

School Address ______________________ School Phone (______) ______________

Which courses are you interested in taking? Pleae check one course during any given time period.

June 15-19
☐ Teacher Utilities Workshop
☐ Word ProcessingI
☐ Math/Science Software Workshop

June 22-26
☐ FrEdWriter Applications Workshop

June 22 - July 3
☐ Beginning BASIC Programming
☐ Electronic Spreadsheets

June 29 - July 3
☐ Problem Solving Software Workshop

July 20-24
☐ Language Arts Software Workshop

July 20-31
☐ Database Management
☐ Intermediate PASCAL Programming

July 27 - August 7
☐ Intermediate LOGO Programming

July 6-18—Computer Institute
☐ Introduction to Using Computers
☐ Beginning LOGO Programming
☐ Beginning PASCAL Programming
☐ Intermediate BASIC Programming
☐ Word Processing II
☐ Integrated Systems I
☐ Evaluation and Integration of Software

August 3-7
☐ Project SETUP Software Workshop
☐ Logo Writer

Which do you plan to register for? ☐ Graduate Credit ☐ In-Service Credit ☐ No Credit

Do you plan to live on campus? ☐ Yes ☐ No

Mail to:
Ted Ostrander, Dir., Computer Education, Fresno Pacific College, 1717 South Chestnut Avenue, Fresno, CA 93702.

For Office Use Only

Date Received: ______________ Processed by: ______________

Copy to: ☐ Registrar ☐ In-Service ☐ Business Office ☐ Housing

The AIMS Education Foundation

announces the

AIMS National Leadership Program in Mathematics and Science

Introduction

The **AIMS National Leadership Program** will provide training in science and mathematics for selected teachers in grades K-9 using the integrated mathematics/science approach of Project AIMS. This program will provide intensive training in the physical, biological, earth science, and mathematics topics and the science process skills.

Participants will receive 300 hours of instruction during this two summer program sequence. Participants may enter the program during any summer. Each teacher selected will share this instruction during the following academic year with six or more teachers in the local district or region. Participants will provide a minimum of 50 hours of such instruction per academic year during the two-year program.

Participants for this Program will be selected on a competitive basis as outlined in the attached application form. Upon successful completion of this program, participants will qualify to become members of the **AIMS National Leadership Network**. Such membership qualifies the trainer to conduct Project AIMS workshops, teach AIMS in-service courses for college credit, and serve as a Project AIMS consultant to help meet the widespread and growing demand for such services.

Program Information

Location and Schedule

The program components are: two sessions of the AIMS National Leadership Institute (one per summer); the Science Festival; and the Festival of Mathematics. Each is an intensive two-week program which will be available every summer. All programs are offered on the Fresno Pacific College campus where excellent air-conditioned classrooms and residence facilities are available.

Participants will follow this schedule: Summer 1987 - AIMS National Leadership Institute, July 6-17, 1987
Science Festival, July 20-31, 1987
Summer 1988 - Festival of Mathematics
AIMS National Leadership Institute

Program Activities

For California residents, the program content is driven by the Science Framework Addendum, Mathematics Framework, the physical science recommendations in the Model Curriculum Standards, and the rationale and content of the CAP tests. Where out of state participants are involved, special attention will be directed to the respective state frameworks, testing instruments, and curriculum guides. Major topics in physical, biological and earth science, and in mathematics will be covered by specific instruction and related hands-on experiences. The overall approach will be in a manner and in language appropriate to the needs of elementary/middle school teachers, taking into account possible knowledge deficiencies, fear of hands-on activities and divergent thinking, feelings of insecurity in mathematics or science content, and the need for classroom management information and evalualtion procedures.

The full resources of Project AIMS, including all of the new activities now under development, will be brought to bear on this program. The exciting and pioneering materials emerging from Project SETUP (Software Evaluation and Teaching Utilities Program) will be included. SETUP materials consist of a score of problem solving, simulation computer programs that are fully supported by appropriate and essential materials developed at Fresno Pacific College, and which help to integrate these programs into the on-going curriculum.

Materials Description and Program Cost

The cost for the materials and the basic instructional fees for this program is over $4500. However, the AIMS Education Foundation is making a major contribution that reduces the program cost, without college credit, to $2600 per participant! This special reduced price is available exclusively to the participants selected for this program. Individuals taking the program for college credit would pay an additional tuition fee.

APPLICATION

(Application may be photocopied)

AIMS National Leadership Program in Mathematics and Science

This application is intended for district endorsed applicants to the AIMS National Leadership Program.

NAME OF APPLICANT ______________________________

Address ______________________________

____

School ______________________________ Grade Level __________

School Address ______________________________

____

Home Phone ____________________ School Phone ____________________

DISTRICT PERSONNEL ENDORSING AN APPLICANT:

Name ______________________________ Position __________

School District ______________________________

Address ______________________________

____

Telephone ______________________________

FUNDING SOURCE: (Check one) ☐ Applicant ☐ School District:

Complete the following if District funded:

Funding authorized by ______________________________

Title or Position ______________________________

Address ______________________________

____

APPLICATIONS SHOULD BE SUBMITTED TO:

AIMS Education Foundation • P.O. Box 7766 • Fresno, CA 93727

Application Information

The accompanying application must be filed by June 20, 1987.

The preferred response is one in which the school district uses this as a way to implement a school-wide program of staff development in mathematics and science, particularly the integrated approach, and funds the participation of one or two teachers. Where two teachers are selected from the same school or district, each will receive the full complement of materials. In addition, that district will be granted duplication rights to the video-tape series for use in the district only. However, it is possible for individuals to fund their own program with the goal of becoming actively involved in the AIMS National Leadership Network. In either case, there must be district endorsement and a commitment of at least six teachers to take 50 + hours of training during each academic year following a summer's program.

MATERIALS DESCRIPTION/PROGRAM COST (continued from p. 30) The materials included are the following:

1. **Video-Tapes.** The faculty is preparing a series of 16 half-hour video-tapes to be released progressively during the two-year period. These will provide full coverage of the philosophy; underlying learning theory and model of mathematics; classroom management modes; evaluation processes; science processes: selected science, mathematics, and problem solving demonstrations that are inherent in Project AIMS and Project SETUP: and teaching methodologies. The tapes will be an excellent and permanent means whereby local teachers can constantly review critical elements of the program. They will be excellent aids for local in-service programs.

2. **New Project AIMS Books.** Currently, two writing teams of 30 teachers each are working with the Project AIMS Program Directors in the development of new materials to be published in 10 or more Project AIMS books. These will be provided to each participant.

3. **Science and Mathematics Poster Series.** Project AIMS is currently developing two poster series of 100 posters each, one in mathematics and one in science. These are designed to encourage independent investigation, often together with parents at home. This is to encourage parental involvement in the education of their children as a support to the school. Another purpose is to entice students, particularly gifted students, into learning activities in addition to those that are assigned. Each 15" × 20" poster is attractively designed and each has an accompanying 8.5" × 11" blackline master that is a reduction of the poster. Also included is general information for the teacher and suggested procedures and applications.

4. **Special Materials.** The Fresno Pacific Math/Science faculty has developed special materials to help students with topics ranging from basic facts mastery to problem solving in mathematics. These will be provided to participants.

5. **Project SETUP Books.** Each participant will receive 5 of the Project SETUP books to be published during the next two years. These support specific carefully selected commercial computer programs that emphasize problem solving. Support books for such programs as Rocky's Boots, Robot Odyssey, Agent USA, Seven Cities of Gold, etc., are included. In addition, participating schools will be able to purchase selected software at significant discount.

The total program cost, without college tuition, is $2600 due to the subsidy from the AIMS Education Foundation. The program may be taken with or without college credit. If taken for credit, participants can earn 16 semester units of graduate credit applicable, if desired, to the Master of Arts in Education degree, Math/Science Emphasis. The extra total tuition fee for 16 semester units of credit is $360.

Payment Schedule

The first payment of $1300 is due 30 days before the first session selected by the participant. The second payment of $1300 is due one year later.

Room and Board

Room and board for the Festivals and Leadership Institutes are not included in the $2600 cost. Single occupancy room plus board is $28 per day and double occupancy is $20 per day in 1987. Comparable rates can be expected for 1988.

Special In-Service Tuition Rates for Local Teachers

A significant element of the program is the subsidized program of instruction in the local district or region for local teachers. Each participant is required to provide 50+ hours of instruction during each of two academic years as part of the training. Teachers taking this training from an AIMS Leadership Program participant may do so with or without credit. Where college credit is desired, teachers may earn one semester unit of in-service credit for each 16 hours of instruction received. If the course work is taken through Fresno Pacific College, a special reduced tuition rate of $30 per semester unit, one-half the regular tuition, will apply. In addition, such teachers will receive one Project AIMS book of their choice at no cost for each unit of credit earned.

Questions or concerns may be directed to Dr. Arthur Wiebe or Judith Hillen, Project AIMS Directors, AIMS Education Foundation, P.O. Box 7766, Fresno, CA 93747 or by calling (209) 453-2024.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers

301

AIMS NEWSLETTER

A Publication of the AIMS Education Foundation
A Non-Profit Tax-Exempt Foundation

Volume 1, Number 10 May 1987 ©AIMS Education Foundation

AIMS Newsletter Completes First Year of Publication

This issue completes the first year of publication of the AIMS Newsletter. The editors wish to express their appreciation to subscribers for making this venture a success. Subscriptions are well above the number projected for the first year in the schedule that was established when the Newsletter was initiated. Subscriptions have been received from schools and teachers in 44 states. New subscriptions are being entered at an ever increasing rate.

We want to thank those of you who have helped to inform educators about the Newsletter. That has been a major reason for the success of this publication.

Up to this point, information about the Newsletter has been disseminated solely by distribution of sample copies and teacher-to-teacher recommendations. During the second year additional forms of advertising will be used to bring the Newsletter to the attention of educators across the nation.

The response to its content has been most encouraging. Many subscribers report that the Newsletter is in heavy demand, that its contents are widely used, and that it is difficult to keep a full file of the issues available because of this demand.

A full set of ten issues of Volume 1 is still available to new subscribers and libraries. The details are given on the subscription form.

Readers are invited to share items of interest with the Newsletter family. If your school or district is implementing Project AIMS through a systemmatic program we encourage you to submit a descriptive article with black and white photographs. These implementation articles have been helpful to many schools in designing their own programs. Others can benefit from your experience.

Also invited are experiences with the use of AIMS activities and suggestions for new AIMS activities. AIMS is above all a classroom teacher movement and your contribution may offer inspiration and helpful suggestions to other teachers.

The editors are committed to making the Newsletter as useful as possible. All suggestions will be welcome.

Together, let's make Volume Two a rousing success!
We will see you again in August!

"Saturday with AIMS"
PROGRAM ANNOUNCED

There is widespread interest in many regions of the nation for a program to introduce teachers to AIMS. The AIMS Education Foundation is prepared to respond to this need by inaugurating the "Saturdays with AIMS" program. In special situations, consideration will also be given to other days of the week.

"Saturday with AIMS" will be an intensive one-day workshop through which participants will become familiar with the basic principles incorporated into AIMS; engage in an extensive series of hands-on AIMS investigations, and discuss classroom management and methods for integrating AIMS into the curriculum. Participants will receive more than $30 worth of materials, including their choice of two AIMS publications.

Each workshop will be led by a qualified AIMS workshop leader. All leaders have experience in using AIMS in their classrooms. Enrollment in any section will be limited to ensure that the full benefit of the hands-on experience is realized. In general, a miniumum enrollment of 25 will be required and no more than 40 will be admitted to a section.

The cost, including all materials is $65 per participant. One semester unit of credit is available for an additional fee of $25 and the completion of additional assignments.

Locations will be selected in several ways. Schools interested in hosting such a workshop are invited to complete and file the application form on Page 31. Several acceptable dates are requested. Host schools only need to provide space for the workshop at no cost to the Foundation. ALl expenses of instruction and materials for the workshops will be the responsibility of the AIMS Education Foundation.

In some instances the Foundation will take the initiative to schedule workshops based on expressions of interest from individual teachers. It is important that such interest come to the attention of the program directors. Therefore, teachers are invited to complete the form on Page 31 and submit it to the Foundation.

There is no geographical limitation for scheduling these worksops. The instructors can respond to requests from throughout the nation upon assurance of the munimum enrollment. This makes it possible for schools and other educational agencies anywhere in the United States to benefit from these orientation workshops and meet personnel associated with the program.

AIMS National Leadership Network Introduces Ann Wiebe...

The classroom teacher is making a powerful contribution to curriculum and this fact is witnessed in Kings Canyon Unified School District through the superlative efforts of Ann Wiebe. Ann has been the district fourth grade mentor teacher and instrumental in providing AIMS in-service training and obtaining instructional materials and equipment through CTIIP grants. Ann has been associated with AIMS as a writing team member, as a writing team leader, and a workshop trainer. Her latest accomplishment comes to us in the form of a series of fascinating hands-on activities that investigate the nature of soap films and bubbles. She field tested many of these activities with sixth graders after school. "You would be surprised at the geometry, physics and chemistry that can be learned from such simple, enjoyable materials", shares Ann. "We explored minimum surfaces in "Thumbtack Sandwich I and II", the elasticity of soap film in "Stretchng Out", bubble air pressure in "Under Pressure", and the colors reflected from soap film in "Liquid Rainbows". Most days", Ann says, "I had to shoo them out because they kept wanting to do more." These new AIMS activities may be ready for publication as early as Fall '87...

Ann starts off the first week of school with AIMS and averages one or more AIMS lessons each week. She feels that part of science is learning facts and another part is practicing what a scientist does, that is, experimenting. She claims, "They like the experimenting best. As we complete the investigations, we look at the list of science processes on the wall and decide which ones we used. I want them to become consciously aware of these processes."

"In fourth grade, we talk a lot about measuring and weighing accurately. In "Are You a Square?" (Hardhatting in a Geo-World), we decided our shoes must come off before measuring height because our shoe heels were different sizes. In "Big Banana Peel" (Book 1), one group had a total weight that was far different than the peeling and edible part added together, so they went back to re-measure."

☆ AIMS ☆ NEWSLETTER ☆

The **AIMS Newsletter** is published monthly August through May by the AIMS Education Foundation, a non-profit corporation. Editorial offices are located at 5629 East Westover Street, Fresno, California 93727. The telephone number of the Foundation is (209)291-1766. The subscription price is $22.50 per year. Subscriptions are on an annual basis because the content is complete only if all ten monthly issues of a given year are available. Subscriptions entered at any time of the year will include all issues for that year, August to May, making available the entire content of vital articles and the forty or more new AIMS investigations and thirty science and mathematics posters. Address all correspondence to **AIMS Newsletter,** P. O. Box 7766, Fresno, California 93747. **Volume 1, No. 9.**

EDITORS	Arthur Wiebe, Judith Hillen
STAFF ARTIST	Sheryl Mercier
OFFICE MANAGER	Sheryl Bishop
PROGRAM DIRECTORS:	
Fresno Pacific College Math/Science Project	Lawrence E. Ecklund
AIMS Education Foundation	Judith Hillen, Arthur Wiebe
Fresno Pacific Computer Institutes	Ted Ostrander
Project AIMS	Judith Hillen, Arthur Wiebe
Project SETUP	Jim Wilson, Ted Ostrander Arthur Wiebe, Jim Greco

Ann has become very skilled in allowing her students to discover the answers to real world problems by wisely being the "guide by the side". The problem solving process continues when the teacher asks creative questions and the students search for solutions. She feels that geometry comes alive when students explore symmetry via "Mirror, Mirror" (Book 8) and patterns and shapes in "Five Square" (Hardhatting in a Geo-World).

Much of the success of AIMS activities is due to the positive support and cooperative efforts on the part of the Jefferson School principal, Ron Hudson, and the initiative of fellow teachers to use AIMS activities in their classrooms too. Ann says not only did Ron encourage the staff to use AIMS in the classroom but he went so far as to take over her class for her so that she could organize and distribute labs or do demonstration lessons in other classrooms. Jefferson Schoool has also established a science committee to balance the study of earth, physical, and life sciences.

Fellow teachers very generously and eagerly shared these comments about AIMS activities:

Julie Fudge (K): "In Kindergarten, we have been using Project AIMS since the beginning of the year. One of the children's favorites was "Polar Bear Pie" (Glide into Winter). We had one child eat an Eskimo Pie in three bites and another in thirty-three. We really enjoy AIMS because the children learn so much and have fun at the same time. We have also created some similar experiences of our own, such as, "Paddy's pudding is palatable". In this experiment on Saint Patrick's Day, the children made and tested pistachio pudding and decided if it was "palatable" or not. We did a similar experiment with "Yellow yogurt is yummy". Ann and AIMS has encouraged us to extend the "AIMS idea".

"Our class has had a lot of fun with Project AIMS this year. Every week there has been something new in the estimating jar. ("The Jar that Like to Keep You Guessing" - Newsletter No. 3). We started with tennis balls, and have worked down to marbles (perhaps up to marbles). The kids look forward to finding out who came closest on Friday. The activity that suprised the kids the most was "Me and My Shadow" (Book 8). By far the majority thought that the shadows would start short and grow during the day. That day they really learned something about the sun and the earth's moving. The most fun was "Creature Feature" (Seasoning Math and Science, Book A). They estimated, weighed, created, wrote a story and then ate their creatures."

Mona Castaneda (2nd): "I've enjoyed using AIMS projects to teach weighing and estimating. I've had several experiences with the students finding their experiments with an inaccurate weight. My students did "Peanutty Fun" (Seasoning Math and Science, Book B). The weight of their peanuts was not accurate. When I asked them why, they answered that some of the children had eaten many of the peanuts before they were weighed."

Genie Kryder (2-3 combination) has done a half a dozen investigations this year such as Temperature's Rising (Seasoning Math and Science, Book A), M&M's (Newsletter No. 6), Color My World (Seasoning Math and Science, Book A), and Creepy Crawlers (Seasoning Math and Science, Book B). The kids loved all of them, and seemed to learn a lot. I found that I can only get to it if I have a regular weekly time for it."

Joan Loftis (3rd): "In our third grade class the most popular activity was By Golly By Gum (Jawbreakers and Heartthumpers). We did have one problem. The kids were trying to use their problem solving skills to figure out how to keep their gum after the last weighing."

Carole East (3rd): "We have done several AIMS investigations. By Golly, By Gum was a good one. The students weighed bubble gum, chewed it for ten minutes and weighed it again. They were determining just what percent of the gum was sugar. Not only was it a real eye-opener when they saw the results but they felt positively sinful chewing gum in school."

These comments by Ann's fellow teachers and principal are a real affirmation to the commitment and dedication that Ann has demonstrated. We are proud that Ann is part of the AIMS National Leadership Network.

AIMS Rockets Kingsburg into Science!

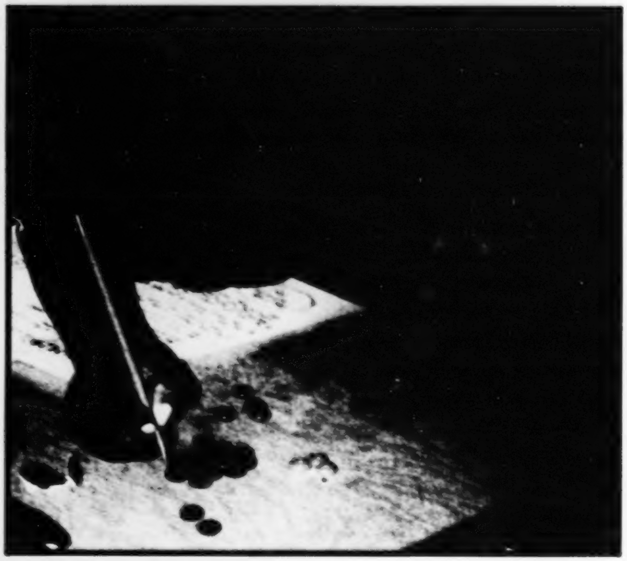
Jim DiAngelous

Project AIMS has been around in the Kingsburg Joint Union Elementary School District since its inception. AIMS was originally brought to the district by Jim DiAngelous and Les Pease, science teachers at Roosevelt School who were members of the initial NSF funded writing project.

Later, other teachers in the district field tested AIMS investigations, attended workshops, and generally became involved with AIMS on their own. But in 1985, though Jim DiAngelous's mentor teacher project, AIMS became the focal point of the district's science program.

The goal of the mentor project was to develop a science curriculum which would provide a continuum for all teachers. In September, 1985, the project began with several organizational meetings to establish a time table for the processes needed to develop district science goals and objectives. Through the following three months the teachers of the district developed the necessary goals and objectives which were needed to have a viable science program at each grade level.

Once the goals and objectives were established, the task of selecting the correct materials to achieve them was enthusiastically tackled by the district teachers. During the process of reviewing the state textbooks, the question of using AIMS materials continually appeared on teacher review sheets and during teacher discussions. In April, 1986, the mentor project provided a staff development day in which Fresno Pacific College, represented by Judie Hillen, provided hands on AIMS experience to the district's 60 teachers. The presentation provided a needed shot in the arm to the teachers and demonstrated the joy of "hands-on" science. Those teachers familiar with AIMS were rewarded to see teachers new to AIMS genuinely excited about teaching and using the AIMS materials in their classrooms. In May, 1986, the teachers selected the science textbooks for the district and requested that AIMS books and lab packages be provided to all teachers in the district. The participation of so many district teachers in the mentor project plus the fact that 80 percent of the teachers were requesting AIMS materials indicated to Superintendent Gary Andreis that this was a program worthy of implementation in the district classrooms and one that would be used with enthusiasm. In May, 1986, the Board of Trustees approved the request of the teachers for the AIMS program.



The purchase of the AIMS materials by the district motivated many teachers in the district to attend summer AIMS workshops at Fresno Pacific College to learn more about this "hands-on" science! The mentor project came to a very successful conclusion in August, 1986, with two exciting days of workshops on AIMS. Teachers Lesli Garst, Chris Sjostrand, and Sandy Skaret were selected by Jim DiAngelous, mentor teacher, to present these workshops to the teachers of the district. Eighty percent of the district's teachers attended the workshop and left ready for an enjoyable and productive year of teaching science.

Beginning in September, 1986, the teachers, using their lab packs and AIMS materials, were ready to teach "hands-on" science. Such "hands-on" experiments as Unbelievable Flying Objects, M&M's, Water Rockets, and making ice cream. Teachers now were doing things with "hands-on" science where last year the order of the day was textbooks and dittos. Now kids look forward to science knowing that they will be doing the experiments and being the scientist. Students, exploring, discovering, and problem solving with AIMS!

Jim DiAngelous has been with the Kingsburg Elementary School District for 15 years as a science teacher. He has taught English, social studies, mechanical drawing, and computer education. Currently he is teaching computer education and science. He is a graduate of California State University at Fresno (B.A.) and Fresno Pacific College (M.A. in Education: Math/Science). He holds a standard Elementary Teaching Credential, a Standard Secondary Teaching Credential, an Administrative Services Credential, and Computer Competency Certificate.

Kingsburg Joint Union Elementary School District is located 25 miles south of Fresno, California, in an agricultural setting. The district is composed of three schools: Washington School (K-2), Lincoln School (K,3-5), and Roosevelt School (6-8). District Superintendent Gary Andreis supervises over 125 certificated and classified staff and 1380 students in the three schools.

The pictures enclosed with this article are from Judy Schafer's 5th grade class at Lincoln School. These students are working on M&M Math from the AIMS materials.

AIMS is Core for Summer Session

The Sacramento City School District is embarking on an innovative summer school program aimed at students in grades 4 through 6 who do not qualify for compensatory education funding. Three schools have been selected to serve 240 students each. A team of six carefully selected teachers at each site is in the process of selecting themes using Project AIMS materials as the core around which they will plan language, reading, art, math, and science activities each week.

Under the guidance of Valerie Lake, Project AIMS Trainer, these eighteen teachers are perusing a broad range of resources, collecting materials, and planning for an exciting six weeks.

Tony Floras, mentor teacher, is coordinating art activities for each AIMS investigation, while reading teachers are collecting books, articles, and research materials to supplement the themes.

Flexible scheduling of the 180 minutes daily will be used at each site to facilitate the individual team needs.

Students Duplicate Superconductor Breakthrough

Nine Gilroy, California teen-agers are the first high school students in the nation to duplicate a project many consider as deserving the next Nobel Prize in physics.

"This is an experiment no other high school student has done before and five months ago nobody on the planet had done", said David Pribyl, chairman of the science department at Gilroy (California) High School.

With the aid of Paul Grant, an IBM scientist, the students are creating a recently concocted superconductive material that has scientists around the world excited about its potential. Grant was instrumental in developing the refined superconductor formula. Television crews have been on the campus of Gilroy High School filming the students' experiment.

A superconductor is a material that conducts energy with little or no resistance loss. It is amazingly simple, though time-consuming, to create the superconductor materials.

"We can't believe how easy this is, " Pribyl said. "Even the physicists are pinching themselves that such a dramatic breakthrough could be replicated by high school students with about $2 worth of material."

The students calculated the required amount of yttrium, barium, and copper to be ground into fine powder, heated to 1,800 degrees Fahrenheit for twelve hours, and compressed into tiny discs. Then the material needed to be reheated for another 12 hours, with oxygen flowing through the setup to create the superconductor, and have liquid nitrogen poured over it to cool it to the required minus 160 degrees.

David Pribyl is currently enrolled in the AIMS National Leadership Program and has conducted numerous AIMS workshops with his colleagues John Licursi, Carolee Maya, Pam Rubio, and Kathy Frazier.

The ceramic material will be able to handle 100 times more electrical current than any other of the new superconducting materials, overcoming the greatest single technical barrier to a new generation of compact high-speed computers, new medical instruments, and efficient power generation and storage. For example, the world's most powerful computers, now the size of several filing cabinets, could "come down to the size of a football and probably operate 10 times faster as well", said Dr. Theodore Geballe director of Stanford University's Center for Materials Research.

The following article is a contribution by an innovative and enthusiastic student teacher, Jerri Anna Hoopes. It is the personal sharing of a beginning...one that she and her students will long remember and cherish.

Hats Off to the Students of Room 4

How lucky I am! As a student teacher I walked into a classroom where the students had already experienced the integration of subject matter. They are an enthusiastic group of fifth-graders, and their love for learning has made Activities that Integrate Math and Science (AIMS) a very successful and rewarding experience for them and for me.

In Room 4, Project AIMS begins by choosing a "lead scientist" for each group and discussing rules which will enhance the hands-on approach. We utilize science process skills and introduce new "science lingo". The fact pages which now are available with many of the AIMS activities have been helpful in providing necessary and interesting information.

When we do Project AIMS we are all scientists. This is a concept that I tried to encourage from the beginning. This was easy because the students feel an importance for what they are doing. They are aware of a problem and enjoy "guessing and testing", which contributes to good problem solving skills. The students know that conditions must remain the same during an experiment in order to gather and analyze data accurately.

I know that the hands-on experience is the link to learning. Without the tangible, we are only distributors of information. My goal is to help build bridges, between the real world and the abstract that will allow students to understand our world. Project AIMS helps build those bridges.

The following comments were gathered from students in Room 4 at Fremont School in Fowler, California. They remain written in the original form.

"In Project AIMS we learn science lingo. Lingo is a kind of slang scientists use. It is very useful for the scientist. We do Project AIMS and now it is useful to us."
Joaquin Murietta

"I enjoy AIMS very much because it is three things in one. First it is very fun. Second it is very educational in Math. Third, it is also educational in Science."
Jason Morrill

"In our class we did rubber eggs. I learned a lot. I learned that corn syryp can not go through the rubber egg, and water can, because water goes through, it created osmosis." Joelle Kinney

"My favorite AIMS project is By Golly By Gum. I learned how to find out the total weight in grams. I also learned how to find out the percentages of people who liked it the most." Keith Monis

"Project AIMS - I liked doing AIMS because it really helped me in math and science. One of our projects was Rubber Eggs. You are supposed to put vineger in a glass. In 2 days, the egg is supposed to turn to rubber."
David Prieto

"I like project AIMS because we learn and have fun doing it at the same time. My favorite activity was "Rubber Eggs." I liked it because when I first saw the egg it looked interesting. After we did the project I did it at home and showed my family. They were very interested in it too." Suzanne Romero

"I like Project AIMS because they are fun. I really enjoyed the Rubber Eggs activity. It was hard to believe how it got after two days in vinegar. We took the egg out and we felt it and it was real slimy and sticky. I really enjoyed the Rubber Eggs activity." Adriana Madrid

"All of the AIMS project are really neat. We all learn something different each time we do one. They're all really fun too." Jeff Davis

"Hi my name is Brandy, and we tried By Golly By Gum. Miss Hoopes, our student teacher, did a project AIMS activity dealing with calories, math and science. That's why I want you to try it." Brandy Morales

"My favorite activity in Project AIMS was Rubber Eggs. I learned when you put an egg in vineger for two days the shell will dissolve and there will be a covering around it called a membrane." John Perkins

"I like Project AIMS because the activities integrate math and science. We write our hypothesis. We also get all the data. Thats why I like AIMS." Diana Pena

"My favorite activity is Rubber Eggs because we learned about Osmosis. It was a new word to me."
Griselda Sandoval

"In Project AIMS my favorite subject is Rubber Eggs. The reason I chose Rubber Eggs is because you get to see the exciting things in an egg. I liked the part when the egg floats in vinegar. Project AIMS is so interesting to me." Michelle Rodriguez

"I liked the Project AIMS activities because we learn about grams and osmosis-like when we did the Rubber Eggs. I learned that if you put an egg in vinegar for 2 days the outside shell will turn to rubber. I think I learned a lot from the Project AIMS activity of Rubber Eggs."
Veronica Urolla

"Who would have known that Musa Sapientum was a banana! That is my favorite AIMS lingo word!"
Miranda Heintz

"I enjoyed AIMS because I learn a lot and have fun. My favorite activity is rubber eggs because an egg gets soft." Romeo Grajeda

"AIMS activities help me learn how to figure out percentages and figure out fractions. So I think AIMS has the best activities ever." Eugene Kandarian

The Nature of Mathematical Microworlds

Mathematical microworlds like real worlds have five specific characteristics by which they can be identified. These are described below.

1. **Territory**
   The territory of a mathematical microworld consists of the arena in which the action takes place. In the example, it is composed of six circular regions arranged in the shape of a triangle and connected by line segments as shown.

2. **Resources**
   The resources consist of the numbers which are used in the problem. Here the resources are one each of the numbers 1-6.

3. **Laws**
   The laws in a microworld define acceptable and unacceptable behavior. In this example, the six numbers are to be placed into the six circular regions in such a manner as to yield the same sum along each side. Each number is to be used once and only once in a given solution.

4. **Objectives**
   In each problem situation the objective is to be stated. Here, and in most instances, the objective is to find all possible sums that constitute a solution.

5. **Opportunity to Engage in Problem Solving Explorations**
   The territory, resources, laws, and objectives set the stage for problem solving explorations that go beyond the use of arithmetic algorithms. Students may use trial and error, hypothesis making, analysis of patterns, synthesis, logic, inductive and deductive reasoning, arriving at generalizations and other higher order thinking skills in the process.

Microworlds are particularly valuable for showing the contrast, appropriate application, and relative power of inductive and deductive reasoning.

Beginning with the February issue, we have been publishing problems involving mathematical microworlds. The first four posters in a new series are part of set PS-2. The fifth problem in that set is similar. Beginning in the August issue, sample problems from set PS-1 will be featured. These are more elementary than those in this set. The analysis accompanying each problem is designed to show the many opportunities to move from the trial and error approach to various levels of logic.

Trapezoid Secrets

The territory of this mathematical microworld consists of 9 circular spaces arranged in the form of an isosceles trapezoid.

The resources are the numbers 1-9, each to be used once and only once for a given solution.

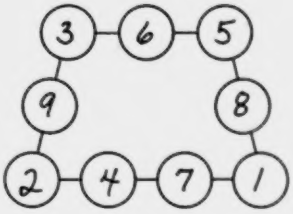
The law of the land is that a solution is discovered when the sum of the numbers on every side is the same.

The goal is to find all possible sums that form a solution.

By this time, very little trial and error is needed if we tap prior experience. Logic provides the highest level approach and the easiest path to solutions.

The sum of the numbers 1-9 is 45. If we place the four smallest numbers at the vertices we must add the sum of 1+2+3+4=10 to 45. 45+10=55. But 55 is not divisible by 4 and therefore this does not result in a solution.

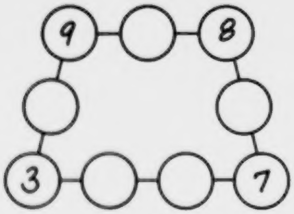
The first number greater than 55 that is divisible by 4 is 56. 56 divided by 4 is 14. So 14 is our first target sum. 56-45=11. Therefore, if we are to find a solution with the sum of 14 we must place four numbers whose sum is 11 at the vertices. What are the possibilities? There is only one: 1,2,3, and 5. After experimenting where to place these num bers, we have a solution if 1 and 2 are placed at the vertices of the longer base of the trapezoid.



What is the largest posible sum? Using the four largest numbers we have: 45+6+7+8+9=75. Since 75 is not divisible by 4 we move down to the first number that is: 72. 72 divided by 4 is 18. Therefore, 18 is our first candidate for the solution with the highest sum. 72-45=27. The sum of the four numbers must be 27. What are the possibilities? Listed in good order we have:

3+7+8+9
4+6+8+9
5+6+7+9

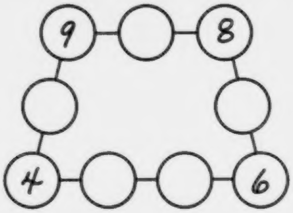
Let's study the first set. After a little examination we note that we cannot use 3 and 7 as pairs on any three-circle side because we would then need to place 8 between 3 and 7 to obtain a sum of 18. But 8 must be placed at a vetex. Therefore, the only place we can try 3 and 7 is at the vertices of the four-circle base.



If we next try 8 at the vertex nearest 3 we find we need a 7 to place between the 3 and 8, but 7 is not available. If we place 9 there, we can use the 6 between 9 and 3. That leaves the 8 to be placed at the vertex nearest 7. But such a placement requires a 3 between 7 and 8 and it is not available. Therefore, there is no solution involving these four numbers at the vertices.

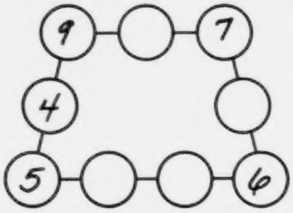
There is an ever more elegant path of reasoning. 3,7, and 8 total 18, the target sum. It is clear that if any two of these numbers are at the vertices of the three-circle side we would need to use the other as the middle number between them. Therefore no pair can be used at such vertices. But, there is only one pair of numbers that can be used at the verticies of the four-circle side. If two of the three are placed there, the third would still have to be used with one of them along a three-circle side. Therefore, there can be no solution. A similar type of reasoning may be followed in other similar situations that follow.

Next we test 4,6,8, and 9. Again we note that 4 and 6 cannot be used on a three-circle side since we would need to use 8 with them to get a sum of 18. Placing 4 and 6 at the vertices of the longer base, we have:



Now, if 8 is placed in the vertex closest to 4 we would need the 6 in the center of that side. If we place 9 there we can place the 5 at the center of the side. That leaves the 8 for the remaining vertex. But we need the 4 to go between 8 and 6 to get the sum of 16 and it is not available. Again, we have no solution.

Finally, we test 5,6,7, and 9. 5 and 6 cannot be used along a three-circle side since 7 would have to be placed between them. So we place them in the vertices of the four-circle base.



If we place 7 in the vertex nearest 5 we need a 6 for the center number. No luck, since 6 must be at a vertex. If we place 9 there, we can use 4 as the center number. Now, we must use 7 at the other vertex close to 6. But we would need 5 as the number between 6 and 7 and 5 is not available. Therefore, this set joins all of the preceeding as one not yielding a solution. As plausible as it seemed at first, there is no solution for 18.

Is there a solution with the sum of 17? 4x17=68. 68-45=23. The sum of the four numbers to be placed at the vertices is 23. What are the possibilities? Placed in good order, this time in descending order, we have these candidates:

9+8+5+1
9+8+4+2
9+7+6+1
9+7+5+2
9+7+4+3
9+6+5+3
8+7+6+2
8+7+5+3
8+6+5+4

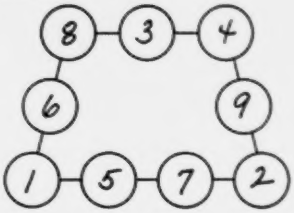
Which of these will give a solution? We leave it for your students to determine whether any gives a solution and if more than one does, which ones.

So far we have examined for the sums of 14, 17, and 18. Only 15 and 16 remain to be tested.

To have a solution with the sum of 15 along each side we need a total sum of 4(15)=60. 60-45=15. The sum of the four numbers at the vertices must be 15. We list these in good order:

1+2+3+9
1+2+3+7
1+2+4+8
1+3+5+6
1+2+5+7
2+3+4+6

The first set does not work since 1, 2, and 3 occupy vertices and at least one pair will bound a three-circle side which needs just a middle number. But even the largest pair from this, 2 and 3, would need a 10 in the center to have a sum of 15 and 10 is not in our set of resources. Clearly we need larger numbers. The second set yields a solution:



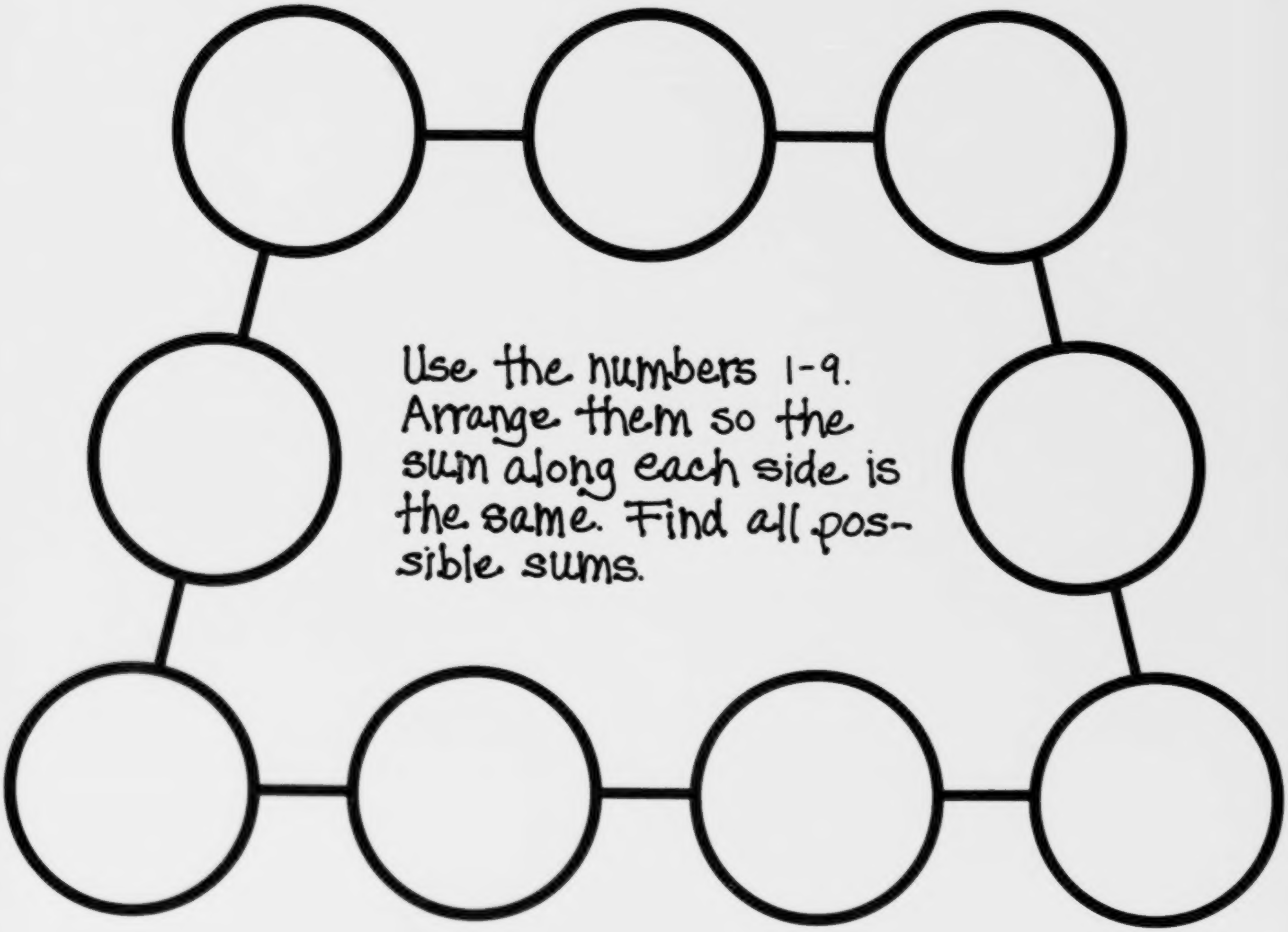
How many of the remaining sets result in a solution? Have your students test these to find the answer.

Our final target number is 16. The total sum must be 4 times 16 or 64. 64-45=19. What combinations of four numbers have a sum of 19? Let's list them. (By this time your students may have developed the ability to list the possibilities in good order and they should be encouragd to develop such lists.)

1+2+4+9
1+3+4+8
2+3+4+7
1+2+5+8
1+3+5+7
2+3+5+6
1+2+6+7
1+4+5+6

We leave it to your students to perform the tests.

Trapezoid Secrets



Use the numbers 1-9. Arrange them so the sum along each side is the same. Find all possible sums.

Plot Your Position

I. Topic Area
Geography-Latitude and Longitude

II. Introductory Statement
Students will plot the boundaries of a fictitious country using coordinate points of latitude and longitude.

III. Math Skills
a. Plotting Co-ordinates
b. Estimating

Science Processes
a. Predicting and inferring
b.. Interpreting data

Social Science
a. Mapping
b. Evaluating and interpreting data

IV. Materials
Practice Worksheets (A easier, B harder)
Mapping Worksheets
Mapping Grid
Ruler
World Map

V. Key Question
By plotting latitude and longitude what are the boundaries of a fictitious country?

VI. Background Information

1. Northern and Southern Hemispheres are divided by the equator. Lines north of the equator are northern latitudes. Lines south of the equator are southern latitudes.
2. Eastern and Western Hemispheres are divided by the Prime Meridian. Lines east of the Prime Meridian are eastern longitudes. Lines west of the Prime Meridian are western longitudes.
3. A cartographer is a mapmaker.
4. In plotting points on an (x,y) axis, points along the x axis are plotted first. In plotting position on a map, lines of latitude are always given first.
   Lines of latitude are comparable to the y axis. Lines of longitude are comparable to the x axis.
   Students who are used to plotting on an (x,y) axis may experience some confusion since they must plot latitude first (along the y axis) and longitude second (along the x axis).
5. For convenience a flat grid has been provided with equal space between each latitude line and each longitude line. In actuality longitude lines are not equidistant. (See information sheet)

VII. Management Suggestions

1. This activity will require:
   a. One 30 minute session to review Social Studies concepts of latitude, longitude, equator, Prime Meridian, hemispheres, direction, and cartography.
   b. One 45 minute session for practice lesson, if needed.
   c. One 45 minute session for map grid.
2. In the actual lesson do not pass out the mapping grid until students have made predictions on the worksheet, since the grid gives visual clues as to the location of the fictitious country.

VIII. Procedure

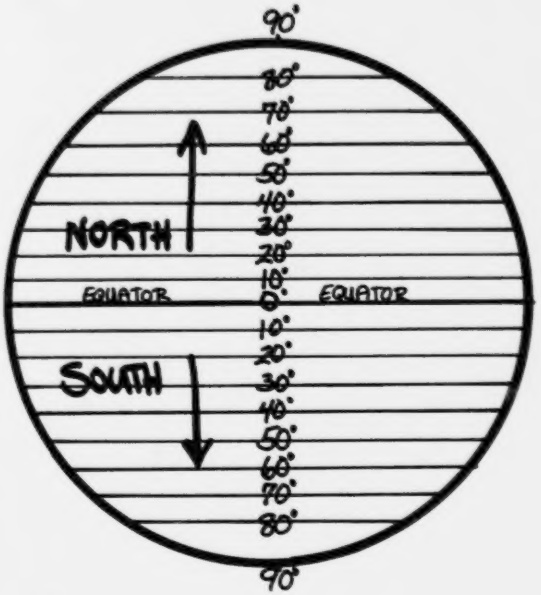
1. If practice is needed in plotting points, do the practice lesson for the appropriate grade level.
2. In the actual lesson pass out the worksheet first. Have students make their predictions before passing out the mapping grid.
3. Pass out the mapping grid and allow students to plot latitudinal and longitudinal points independently.
4. Have students number each point as they plot it and connect all points in order with a ruler.
5. Upon completion use a world map to see exactly where this fictitious country would lie if it existed.
6. The teacher may wish to plot the first few points on an overhead transparency to help students get started.
7. After points have been plotted have students cover the list of points with their map. Call out point numbers and have students give ordered pairs orally for reinforcement.

IX. Discussion

1. Does everyone have a country that is shaped exactly the same?
2. In which hemispheres does this fictitious country lie?
3. Which ocean surrounds this country?
4. What is the nearest continent?
5. What clues are there in the list of points that help you establish this country's location in relation to the rest of the world?
6. What is another word for 0° latitude?
7. What is another word for 0° longitude?
8. Is it possible to live in more than one hemisphere?

(Continued on Page 16)

LATITUDE



Latitude is a measurement on a map or globe of locations north and south of the equator.

Equidistant circles are drawn parallel to the equator and to each other.

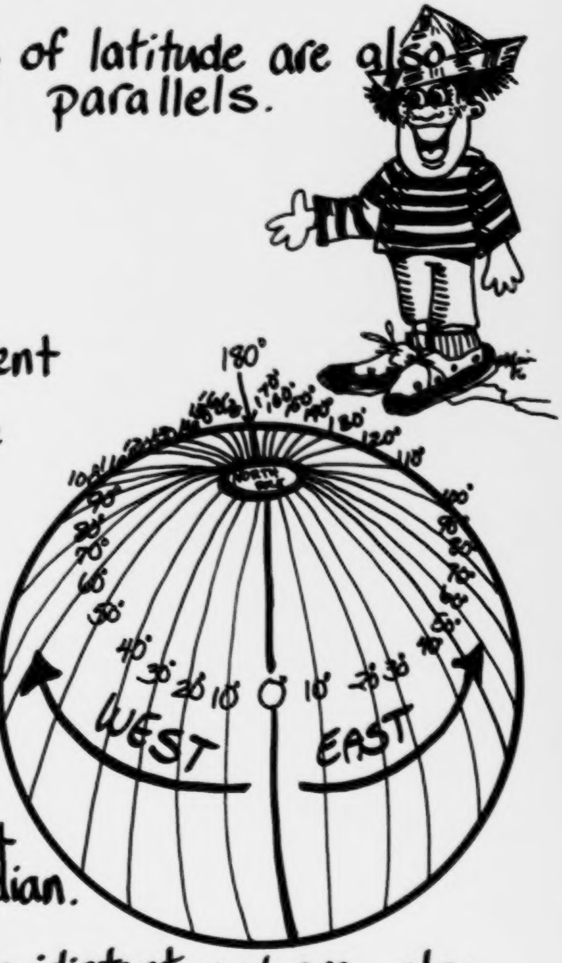
Lines of latitude are also called parallels.

LONGITUDE

Longitude is a measurement on a map or a globe of locations east or west of the Prime Meridian.

The Prime Meridian of Greenwich was chosen as the designated imaginary north-south line that passes through both poles and Greenwich, England.

Longitude is measured 180° East and 180° West of the Prime Meridian.



Lines of Longitude are not equidistant and are also called meridians.

The combination of parallels and meridians form a grid for plotting positions anywhere in the world.

PLOT Your Position

____
CARTOGRAPHER

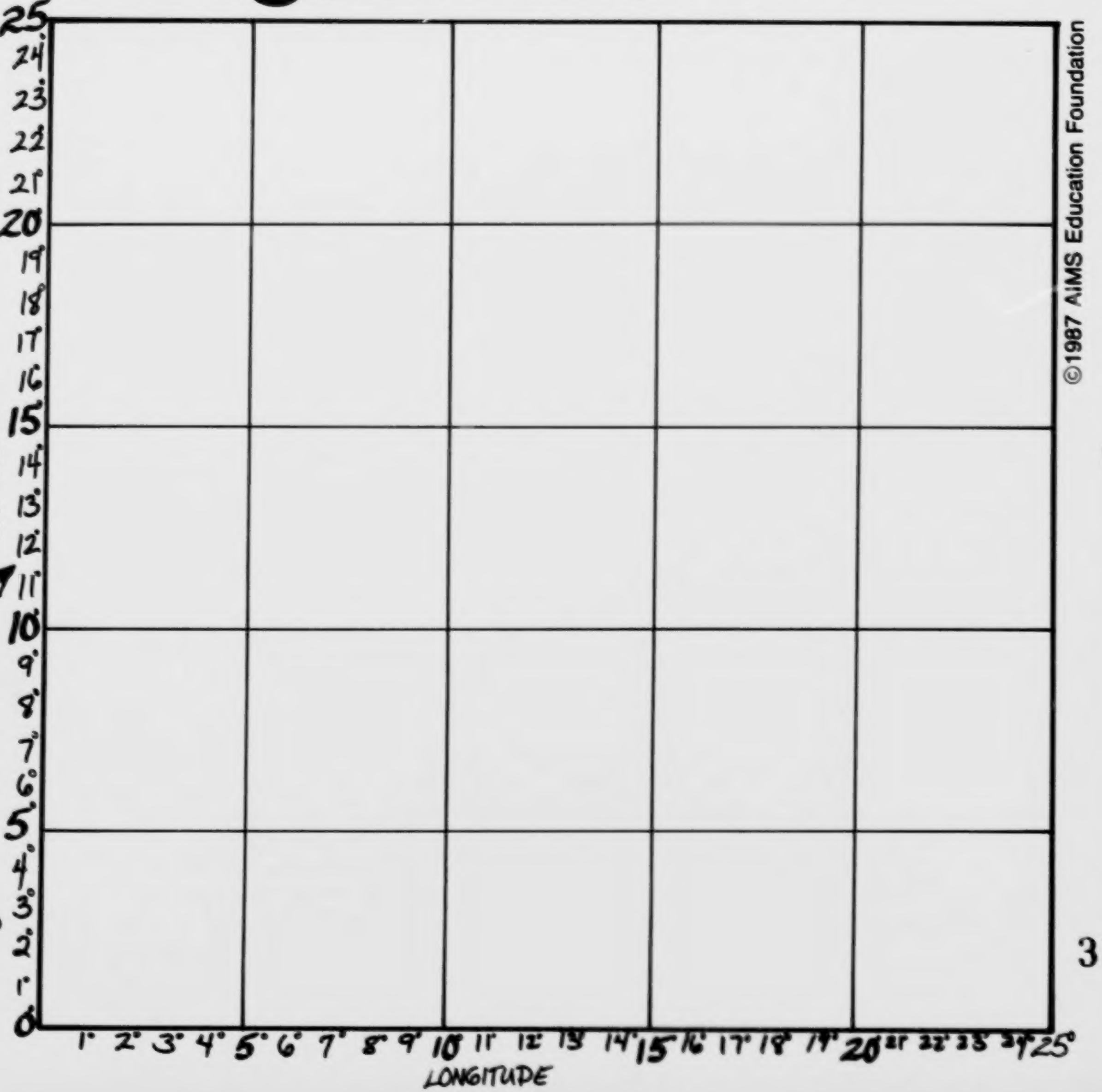
PRACTICE A

Plot each point and connect it to the previous point with a ruler.

Number each point as you plot it.

Note that point 1 and point 13 are the same.

	LATITUDE	LONGITUDE
1.	0°	12°
2.	10°	5°
3.	10°	10°
4.	15°	5°
5.	15°	10°
6.	20°	8°
7.	20°	17°
8.	15°	15°
9.	15°	20°
10.	10°	15°
11.	10°	20°
12	0°	13°
13.	0°	12°



______________ Cartographer

PLOT Your Position

Mapping Sheet A

A. Look at the points of latitude and longitude listed below. The points, when plotted and connected, will create a fictitious country located somewhere in the world.

B. Write your predictions about this fictitious country:

1. Circle the hemisphere you think that this country is in.

NORTH
← WEST EAST →
SOUTH

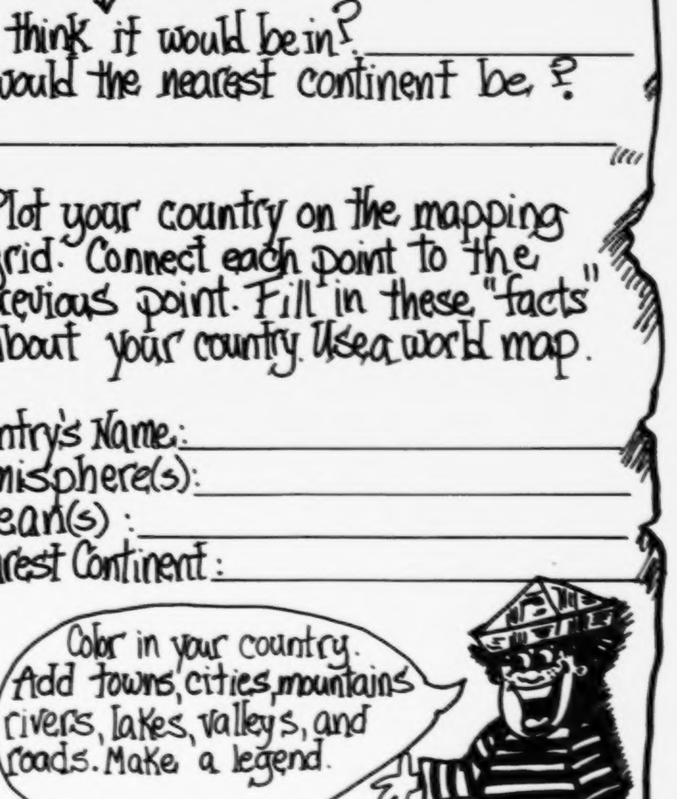
2. Which ocean do you think it would be in? ______________
3. What would the nearest continent be? ______________

POINTS

	LATITUDE	LONGITUDE
1.	10° N	95° W
2.	0° N	90° W
3.	5° S	75° W
4.	10° S	80° W
5.	15° S	75° W
6.	20° S	80° W
7.	25° S	85° W
8.	30° S	90° W
9.	30° S	100° W
10.	20° S	100° W
11.	20° S	110° W
12.	10° S	120° W
13.	5° S	115° W
14.	5° S	110° W
15.	0° N	105° W
16.	10° N	95° W

C. Plot your country on the mapping grid. Connect each point to the previous point. Fill in these "facts" about your country. Use a world map.

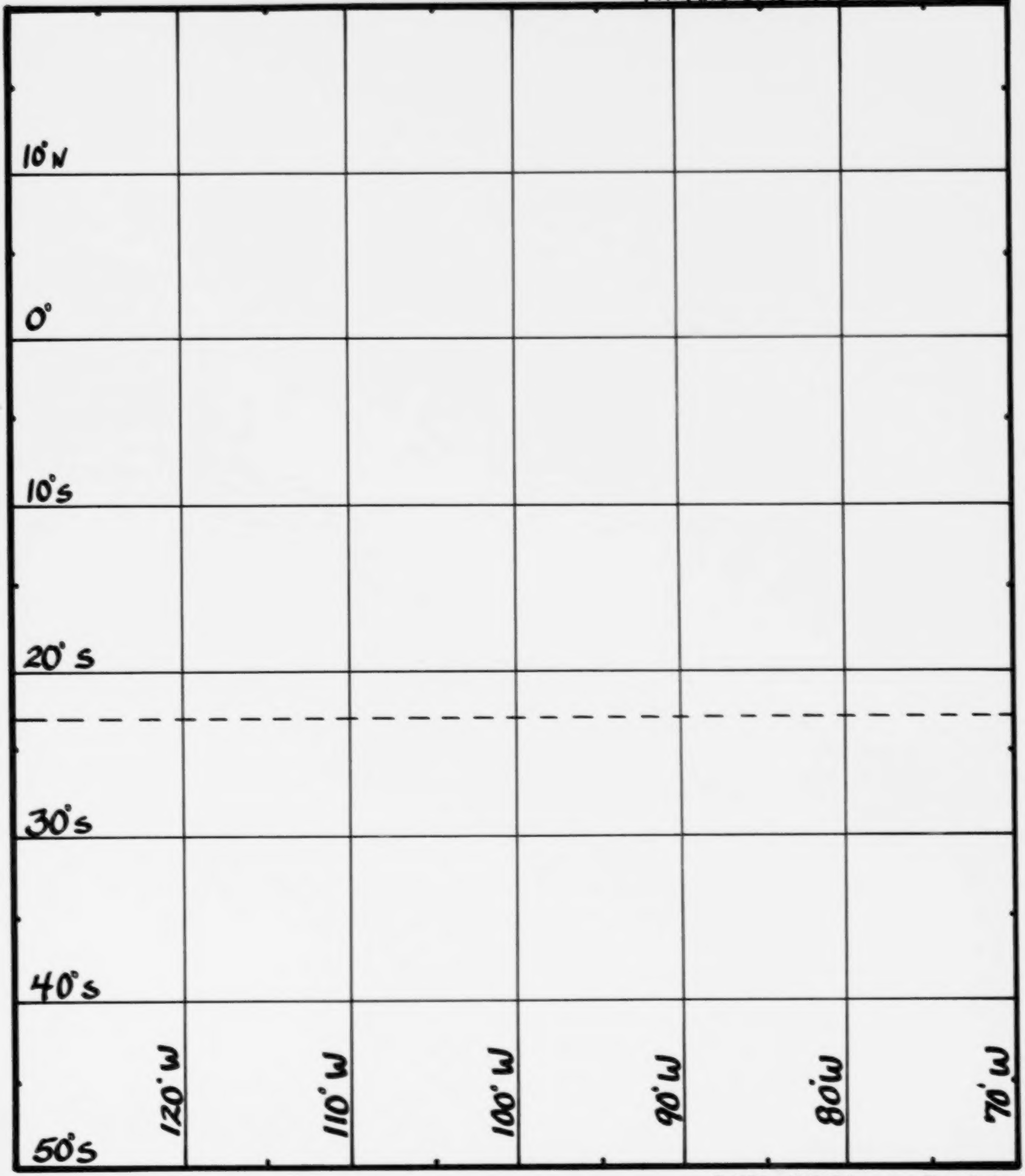
Country's Name: ______________
Hemisphere(s): ______________
Ocean(s): ______________
Nearest Continent: ______________


Color in your country. Add towns, cities, mountains rivers, lakes, valleys, and roads. Make a legend.

PLOT Your Position

______________________ CARTOGRAPHER

MAPPING GRID A & B



Sherlock Combs The Yard

I. Topic Area
Attributes

II. Introductory Statement
Students will collect 3-4 living and/or nonliving items which share an attribute.

III. Math Skills	**Science Processes**
a. Geometry	a. Observing
b. Recognizing and classifying shapes	b. Classifying
	c. Comparing and contrasting
	d. Interpreting data

IV. Materials
One lunch bag per group labeled appropriately

V. Key Questions
Can you collect items with a common attribute? Can you recognize a similar attribute from examining several items?

VI. Background Information
Teacher prepares the paper bags with labels. One side of the bag is identified by group, and the other side is identified by attribute.

Ideas for attributes: seeds, green, red, round, pointed, smooth, shiny, rough, triangles, squares, right angles, smelly, living, nonliving, leaves, sticks, things which float, etc.

VII. Management
1. This may be done in two class sessions of 30-40 minutes each. The first day is the hunt. The second day is for exploring each other's collection and may take up to an hour.
2. Divide class into teams of 2-3 students. Each team will be given a lunch bag with one side labeled Team A, Team B, etc. The other side will have the attribute for which the team is looking. Two teams will have the same attribute given them.
3. Inform the students to keep their attributes a secret.
4. Be sure all students are familiar with the attributes for which they will be looking.

VIII. Procedure
1. Discuss what is to be done and give examples of items which may or may not be collected.
2. Divide students into teams.
3. Give each team a bag labeled as suggested in Management.
4. Give students 10 minutes to find 3-4 items which illustrate their attribute. Each student will record these items on Part I.
5. After the hunt each team will display their collection on their desks with the bag lying flat to show Team A, Team B, etc.
6. Students will move from team to team in an organized manner with their recording sheets and attempt to identify the common attribute. (Part II)
7. Students will try to match collections with like attributes. (Part III)
8. Sharing and discussion. Fill in "actual" answers on Parts II and III.

IX. Discussion
1. What is each team's attribute?
2. Which teams collected items with a similar attribute?

X. Extensions
1. Include measurement
2. Work with Attribute Blocks and People Blocks
3. Use Venn Diagrams

Plot Your Position Continued...

X. Extensions
1. On a large world map plot the points so students can visualize the location of the fictitious county in relation to the rest of the world.
2. Have students research information about the Tropic of Cancer and the Tropic of Capricorn.
3. Discuss who might have discovered this country, what kind of people might live there, and what language might be spoken.
4. Make up a name for the country.
5. Find the latitude and longitude for the city or town where you are now. What other cities or towns lie along the same lines?
6. Use road maps to demonstrate another way to find positions on maps. This will show students a practical use for knowing how to plot points.

XI. Curriculum Coordinates
1. Language Arts-Write a news article. NEW COUNTRY DISCOVERED BY ROOM ____.
2. Math-Using a protractor figure out the interior and exterior angle at the coordinate points.
3. Computer-Having figured out the angles, use LOGO to create the country on the computer screen.
4. Science-Discuss climatic differences in the Southern Hemisphere. Why are the seasons opposite to the seasons in the Northern Hemisphers?
5. Art-The practice worksheets create symmetrical patterns. Cut out or draw symmetrical pictures.

Sherlock Combs the Yard

________________ Name.

1. Your team has 10 minutes to collect at least 4 objects with a common attribute. Read the attribute label on the bag but keep it a secret from other teams. Go outside, collect, and record.

My team's attribute is: ________________________.

Our team collected: ________________________

____

____

2. Return to the room and display your objects but keep the attribute a secret. Study objects collected by other teams and predict the attribute each team used.

TEAM	PREDICTION	ACTUAL
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		
M		
N		

3. Which groups have a similar attribute?

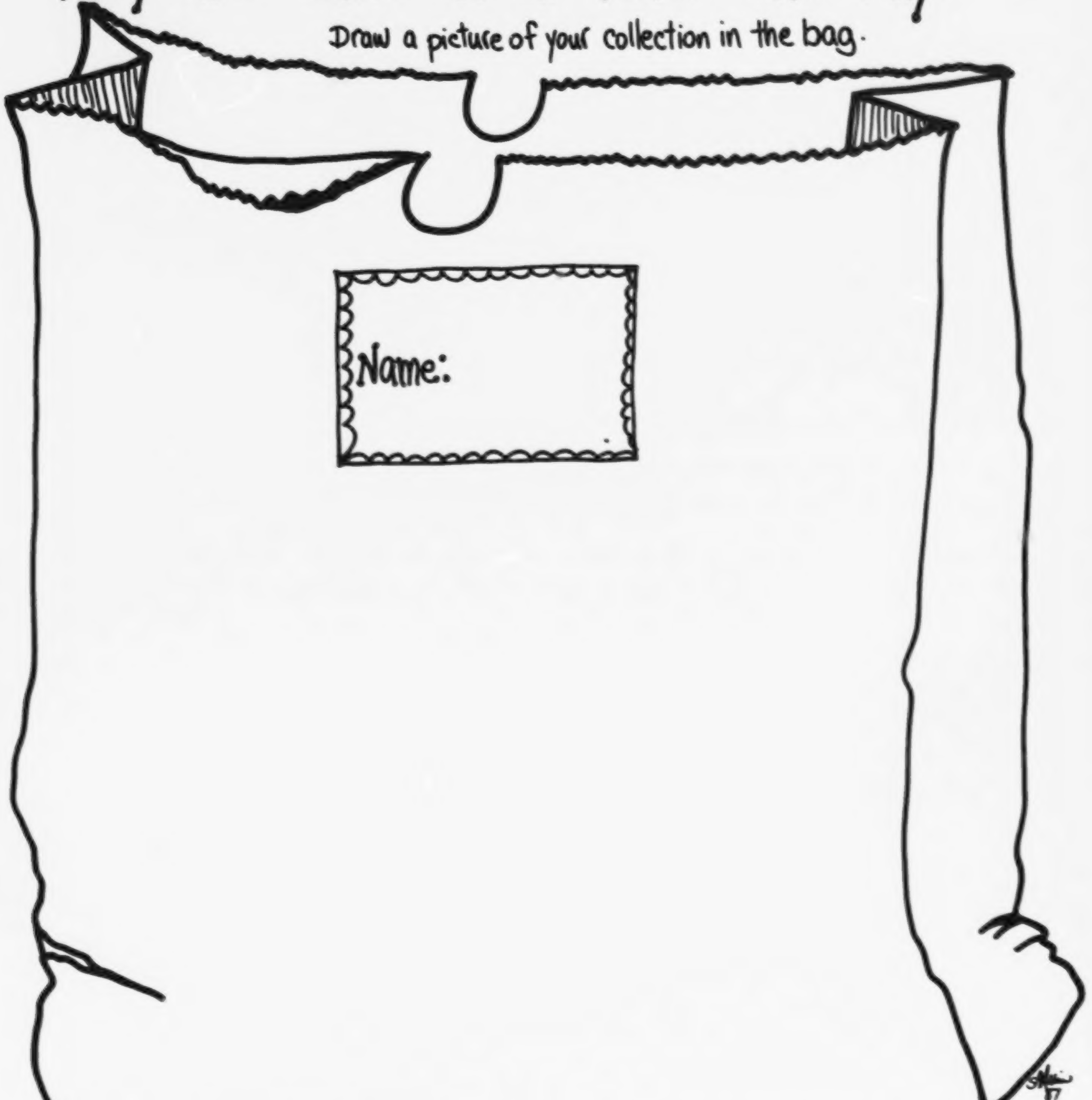
Prediction	Actual
A and ____	A and ____
B and ____	B and ____
C and ____	C and ____
D and ____	D and ____
E and ____	E and ____
F and ____	F and ____
G and ____	G and ____

BAG LABELS : SHERLOCK COMBS THE YARD

TEAM A	TEAM M	COLLECT: Things that are Green	COLLECT: Things that are Green
TEAM B	TEAM K	COLLECT: seeds	COLLECT: seeds
TEAM C	TEAM N	COLLECT: Things that are Square.	COLLECT: Things that are Square.
TEAM D	TEAM H	COLLECT: Things that are Pointed	COLLECT: Things that are Pointed
TEAM E	TEAM I	COLLECT: Things that are Shiny	COLLECT: Things that are Shiny
TEAM F	TEAM L	COLLECT: Things that are Rough	COLLECT: Things that are Rough
TEAM G	TEAM J	COLLECT: Things that Float	COLLECT: Things that Float

How are These Alike?

I picked up these things outside.
They are alike in at least one way.



Draw a picture of your collection in the bag.

These things are all ____________________.

"Raisinably" Sure

I. Topic Area

Probability

II. Introductory Statement

In this investigation students will determine whether the packager of raisin snack packs has met the stated net weight requirement. Such statements are required by federal law to protect the consumer.

III. Math Skills

a. Estimating
b. Finding mass
c. Computing percentages
d. Determining unit cost
e. Computing averages

Science Processes

a. Predicting
b. Measuring mass
c. Recording data
d. Interpreting data
e. Generalizing

IV. Materials

One box of snack pack raisins for each student group
Scales and masses
Student worksheet

V. Key Question

Did the packager of raisin snack packs meet the net weight standard stated on the box?

VI. Background Information

1. If possible, use several brands of raisins and make a comparison among brands. Check to make sure that packages specify the same net weight. Usually, the packages come in six-packs. Give the students the cost of the six-pack to provide additional practice in computing cost.
2. The percentage over (under) is found by dividing the difference between the stated and actual mass by the stated mass since the stated mass is the standard.
3. The cost per gram is found by dividing the cost by the number of grams. The number of raisins per gram is found by dividing the total number by the number of grams. The number of raisins per penny is found by dividing the number of raisins by the cost in pennies. The measure after "per" is the divisor.
4. The mass of an average raisin is found by dividing the total mass by the numbers of raisins (grams per raisin).
5. The average cost of a raisin is found by dividing the cost by the number of raisins (pennies per raisin).
6. The average number of extra raisins in these boxes is found by taking the average difference over the stated net weight and dividing that by the average mass of a raisin. See the fact sheet on raisins for information as to how they are produced.

VII. Management Suggestions

1. Before beginning the investigation provide students instruction about solving problems such as those encountered in this activity as discussed under Background Information.
2. Divide the students into groups of four and assign a specific task to each group member. These tasks include setting up the scales and making sure they are in balance; handling the raisins (for counting each should take some of the raisins) and doing the weighing; recording the data; and leading the discussion as to how each of the problems is to be solved. Each of the students should compute the answers which should then be compared and an answer agreed to.
3. Have each group read the data for the first four columns so that all other groups can record the information.
4. Have each group make all of the computations for all information. This is to give maximum practice in solving these types of problems.
5. After the computations have been completed, have all of the groups share their results and compare them. Discuss any differences.
6. After the computations have been checked, let each group complete the graphs.
7. Discuss the graphs.

IX. What the Students Will Do

1. Predict the number of raisins they think are in the box.
2. Predict the number of raisins per penny.
3. Find the masses of the full box, empty box, and raisins.
4. Record the data in the table.
5. Make the computations required for the table for each of the groups and those required to answer the three questions.
6. Compare results.
7. Graph the results.

X. Extensions

1. Students may wish to compare even more brands and report the results to the packager.
2. Prepare a report on the growing of grapes and the production of raisins.
3. Try to produce raisins from fresh grapes.

"Raisinably" Sure

____
Product Inspector

What margin of error did the packager of raisin snack packs use to make sure the net weight is not less than stated on the package?

Predictions:

Name Brand: ______________ How many raisins do you predict are in the package? ________
Package Price: ______________ How many raisins do you think you get for a penny? ________

Package Number	Mass of the Full Box	Mass of the Empty Box	Net Mass (Mass of the Raisins)	Stated Net Mass	Difference Over (Under)	Percentage Over (Under)	Cost per Gram of Raisins	Total Number of Raisins	Number of Raisins per Gram	Number of Raisins per Penny
1										
2										
3										
4										
5										
6										
		Average								

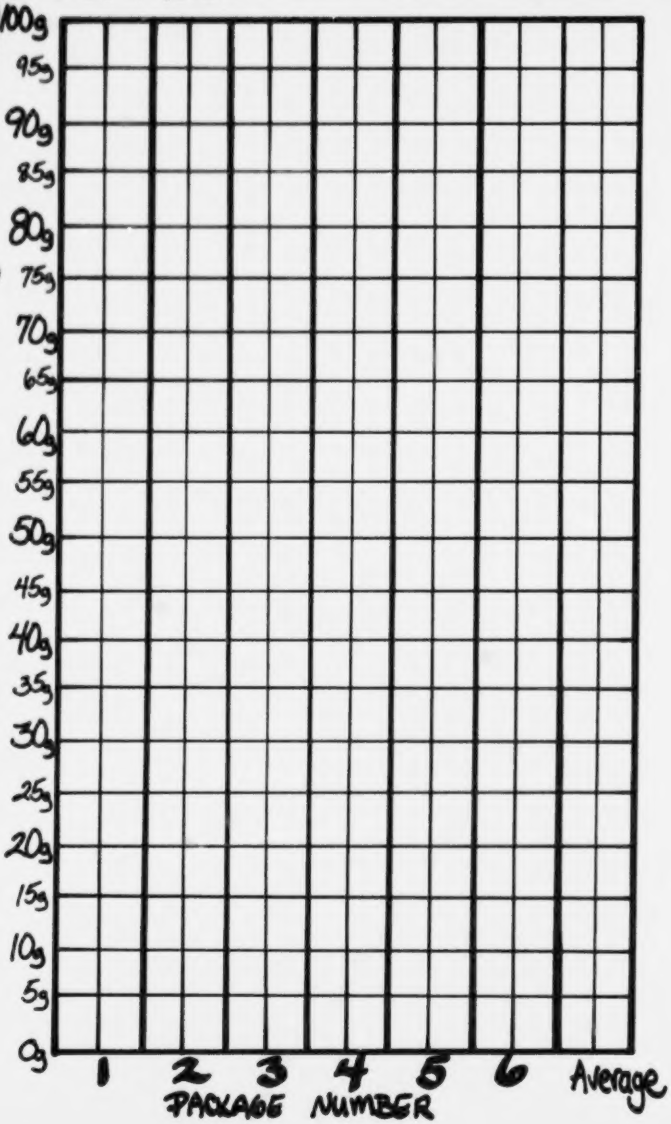
Enter the information in this table

The mass of an average raisin is ______ gram.
The average cost of a raisin is ______ cent.
The average number of extra raisins in these boxes is ______ raisins.

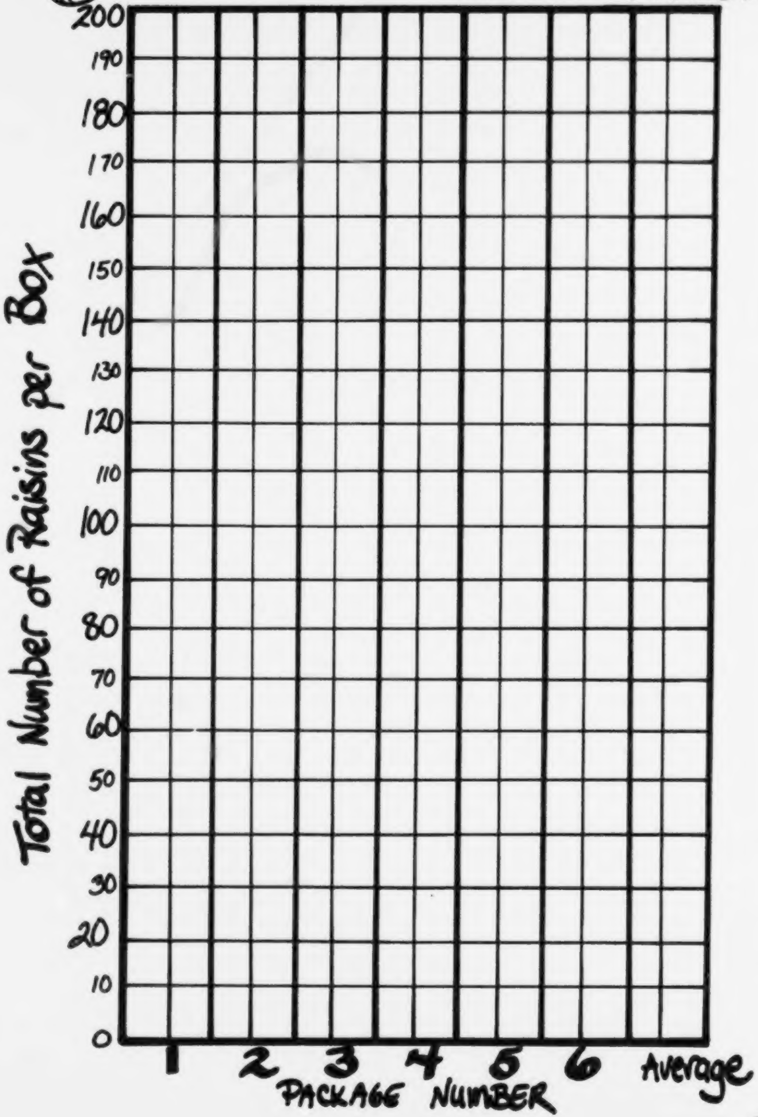
_______________ Package Inspector

“Raisinably” Sure

NET Mass



Number of Raisins



Who's Not Home?

I. Topic Area

Patterning and logical reasoning

II. Introductory Statement

In the following activities students will determine what color Teddy Bears belong in each of the blank spaces of the matrix by noting the pattern of the bears that are at home.

III. Math Skills

a. Discovering a pattern
b. Observing symmetry
c. Extending a matrix pattern
d. Using logic

Science Processes

a. Observing
b. Interpreting data
c. Inferring
d. Applying

IV. Materials

A supply of Teddy Bears or pictures of Teddy Bears in the indicated colors
Student worksheet

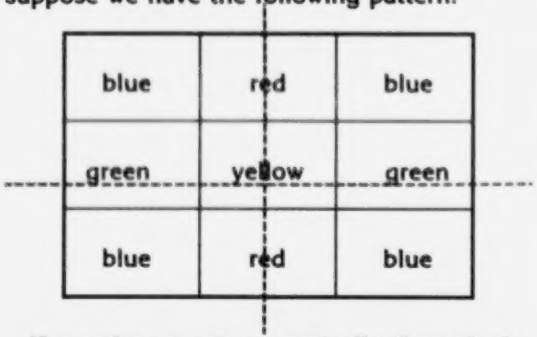
V. Key Question

What color Teddy Bear lives in each of the empty homes?

VII. Background Information

This series of activities follows a common theme: discovering the color pattern represented by the Teddy Bears who are at home, generalizing that pattern, and using it to determine the color of the Teddy Bears who are not at home.

Often, these are studies in symmetry. Several types of symmetry should be noted. First, line symmetry is that in which the pattern could be simulated by a mirror. That is, if the mirror is placed somewhere in the pattern it shows in the reflection what color Teddy Bear(s) should be placed in a certain position. For example, suppose we have the following pattern:



blue	red	blue
green	yellow	green
blue	red	blue

If we place a mirror vertically through the center as shown by the vertical line and look into the mirror from the left side, we see a pattern in the mirror that is the same as what is behind the mirror to the right.

Similarly, if we place the mirror on the horizontal line through the center of the pattern and look at it from the bottom, we see in the mirror the pattern that lies behind the mirror above the line.

Whenever we can place a mirror through the center of a pattern in some manner and see in the mirror what is behind the mirror we have line symmetry.

The above pattern also has point or rotational symmetry. The point in this case is in the center of the square occupied by a yellow Teddy Bear. Note that if you proceed from any color through the center square to the third square, its occupant will be on the same color as that in the first square. The rotational symmetry is demonstrated by the fact that the pattern in this case can be rotated 90 degrees each time and the same color pattern as existed originally reappears.

Students may find other patterns which can be logically explained that are not necessarily symmetrical, for example, a checkerboard arrangement. This is acceptable as long as a logical explanation can be given, but the pattern that is explained must be applicable throughout the arrangement.

Matrices are used often in science for classification as well as in mathematics. These activities fit well into that part of the science curriculum which deals with classification through the use of matrices.

VIII. Management Suggestions

1. Divide the students into groups of two or more. This is to encourage discussion among the students about the color of the missing Teddy Bears. They need to agree that the pattern they have selected is consistent throughout the arrangement.
2. Provide each group with a sufficient number of Teddy Bears of each color and the student worksheet.
3. Have students defend their pattern by describing the pattern and using logic to explain their solution.
4. Accept any solution which is supported by sound logic.

IX. What the Students Will Do

1. Discover the pattern.
2. Fill the missing homes with Teddy Bears of the correct color.
3. Describe the pattern they discovered and defend it by recording their explanation.

(Continued on Page 28)

Who's Not Home?

Name: ____________________

The Teddy Bears who live in the rooms of each cave are always arranged to form a color pattern. What color Teddy Bears should live in the rooms where no one is at home?

First, arrange the Teddy Bears who are at home according to the colors shown. Then discover what color Teddy Bears should be placed in the empty rooms.

Cave 1

	yellow	red
yellow	yellow	yellow
red		red

Cave 2

blue	red	blue
red	blue	
	red	blue

I added 2 colors __________ and __________
because ______________________________
____
____

I added 2 colors __________ and __________
because ______________________________
____
____

Who's Not Home?

Name: ____________________

The Teddy Bears who live in the rooms of each cave are always arranged to form a color pattern. What color Teddy Bears should live in the rooms where no one is at home?

First, arrange the Teddy Bears who are at home according to the colors shown Then discover what color Teddy Bears should be placed in the empty rooms.

Cave 3

red	green	yellow
green	yellow	
yellow	green	

Cave 4

red	blue	
green	blue	green
	blue	yellow

I added 2 colors ________ and ________
because ____________________
____
____

I added 2 colors ________ and ________
because ____________________
____
____

WEIGHING OBJECTS IN WATER

GENERAL INFORMATION

Buoyancy is defined as the power to float or rise in liquid or air. (A buoy is an object floating in water and held in place by an anchor to warn of danger or to mark a channel.) Another definition states that buoyant force is the upward force that a liquid or gas exerts on bodies placed in it.

The Greek philosopher, Archimedes (287-212 B.C.), discovered that the buoyant force which a liquid exerts upon an object in the liquid is equal to the weight of the amount of liquid the object displaces.

An object under water weighs less than it does out of water because of the water's buoyant force. An object will sink in water if the weight of the water that it displaces is less than the weight of the object. (Example: If a gallon jar is filled to the brim with water and then a 16 pound steel ball is placed into the container, some water would be displaced. This means that some water would overflow and the steel ball would take up the place of the water that spilled out of the container. If all of the overflowed water were collected and weighed, it would weigh less than the steel ball.) On the other hand, if an object is placed in the same container filled to the brim with water and it floats, the weight of the water that overflows is equal to or greater than the weight of the object. (Example: If a piece of wood were placed into the water, some water would spill out of the container. The weight of the spilled water would be equal to or greater than the weight of the wood.)

MATERIALS

If possible use a small baby food jar or a container about that size so it can be lowered into the opening of a quart or gallon jar. Ideally, a small aquarium or clear plastic storage box should be used. After the water has been added to the large container, mark the water level with a piece of masking tape. During the experiment the student will be able to observe the water being displaced by watching the water level rise above the masking tape.

PROCEDURE

1. Follow procedure #1 as given on the student activity sheet.
2. If you are using a spring scale that shows the graduations in both ounces and grams, discuss the equivalent ounce/gram conversion—an ounce of water weighs approximately 28 grams. Record the weight of the jar and string before it is one-half filled with water. Fill the jar half way with water and weigh it again. Have students predict what the weight of the jar and water will be when it is placed in the water.
3. Record the weight when it is placed in the water.
4. Follow procedure #4 as suggested on student activity sheet. Before placing the jar filled with water into the aquarium, have students estimate what its weight will be.

POSSIBLE ANSWERS TO QUESTIONS

1. The jar when half filled, and when completely filled with water, weighed more in the air than when in the water. If using a small baby food jar, it will weight about 200 grams out of the water and just a few grams when placed into the container filled with water. The half-filled baby food jar will float. This means that the water it displaces weighs more than the jar and the water.
2. Repeat the procedure using the jar half-filled with sand. Repeat using the jar completely filled.
3. Some students should be able to relate this principle to the experience of being in the water. Ask if anyone has tried to retrieve an object from the bottom of a swimming pool. A swimmer has to overcome the upward force of the water (buoyancy) in order to get down to the bottom.
4. This experiment demonstrates that objects weigh less in water than they do out of water.

APPLICATION OF CONCEPT AND EXTENSION ACTIVITIES

Most students have probably experienced the effect of buoyancy on their bodies either in a bath tub or in a swimming pool. You can relate the results of the demonstration to their experiences. People can lie motionless in a swimming pool and the buoyancy of the water will support their weight, causing the body to float on the surface of the water.

Add salt to the water and repeat procedures 1 through 4. Will the small jar filled with water weigh more or less in the salt water compared to the fresh water?

Weighing Objects in Water

• Materials:

- Spring Scale
- String
- Small jar with lid
- Masking tape
- Gallon jar or aquarium
- Water

• Procedure:

1. Fill the jar or aquarium 3/4 full of water. Fill the small jar 1/2 full of water. Secure the top on the jar. Tie a piece of string around the jar. Tape the string to the glass to keep it from slipping.
2. Using the spring scale, weigh the jar and record the results.
3. Place the jar in the large jar or aquarium while holding it with the spring scale. Record its weight.
4. Remove the lid from the small jar and fill it completely with water. Weigh it out of the water and weigh it in the water.

• Questions:

1. Did the jar weigh more in the water or in the air?

2. What do you think the results would be if you used sand in the small jar instead of water?

3. Does your body weigh more in or out of water?

AH HA!

4. What does this experiment demonstrate?

First 1988 Summer Workshop Sites Approved

School districts and educational consortia have begun to file their applications to host Summer, 1988 AIMS Workshops, the program announced in the April issue of the AIMS Newsletter.

The first agencies and sites receiving approval include the Los Angeles County Office of Education with Gerlena Clark as coordinator and the Glendale Staff Development Center as the site; the Fontana Unified School District with Jane Smith as coordinator and Southridge Middle School as the site; and Tustin Unified School District with William Watts as coodrinator and Guin Foss School as the site.

Negotiations are now in progress with consortia in the mid-western and eastern states. It is anticipated that a number of these will be announced in the August Newsletter.

A total of 30 sites will be selected by the AIMS Education Foundation of which up to 15 will be in California and 15 or more at other location throughout the nation.

Potential applicants are urged to submit their applications as early as possible to ensure consideration. Based on expression of interest received to date, it is anticipated that most of the sites will be selected by September 30. This will permit thorough advance planning and preparation to ensure that each experience will be of highest quality.

The application form with a description of conditions is on Page 31.

Who's Not Home Continued...

X. Discussion

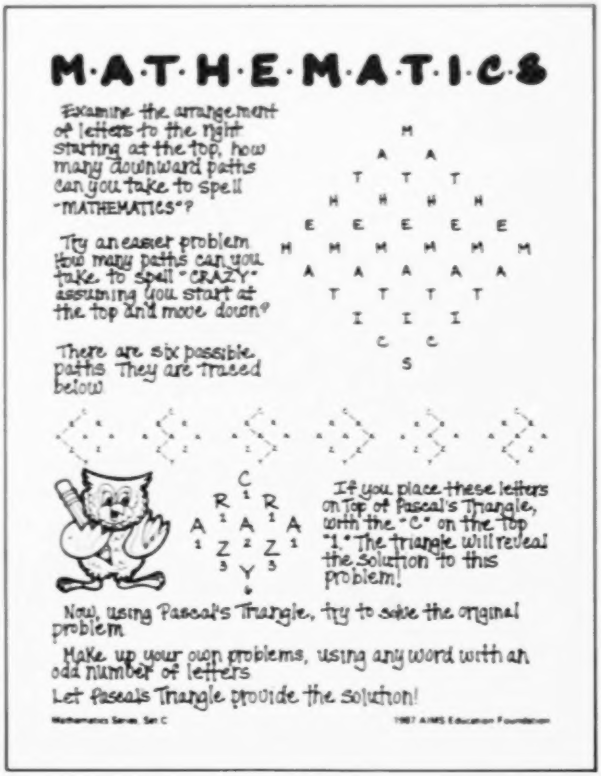
Have students share their solutions and discuss the reasons behind them. One of the major objectives of these activities is to use logical reasoning.

Note: These activities are taken from the content that will be incorporated into the **Primarily Teddy Bears** AIMS publication scheduled for release this summer. A series of ten pattern problem solving investigations will be included ranging from simple to moderately difficult. Another series of ten activities will be similar to the Bear Logic activities in the April issue. The publication also includes a good number of investigations of several other types. The entire volume will have more than 60 student activity pages, the most of any publication to date. The content is so selected that it is suitable for use in grades K-6.

SOLUTIONS AND COMMENTS

M-A-T-H-M-A-T-I-C-S

The principle behind problems of this type is that each number in Pascal's Triangle represents the number of zig-zag paths from the top of the triangle to the position of the number. This is illustrated on the poster with the word CRAZY. Hence, to solve the M-A-T-H-E-M-A-T-I-C-S problem, you need only determine what number in Pascal's Triangle corresponds to the bottom "S." If the array of letters in our problem were super-imposed on Pascal's Triangle, the bottom "S" would fall on the number in the middle of the 11th row, namely 252--our solution!



M·A·T·H·E·M·A·T·I·C·S

Examine the arrangement of letters to the right starting at the top, how many downward paths can you take to spell "MATHEMATICS"?

Try an easier problem How many paths can you take to spell "CRAZY" assuming you start at the top and move down?

There are six possible paths They are traced below

If you place these letters on Top of Pascal's Triangle, with the "C" on the top "1." The triangle will reveal the solution to this problem!

Now, using Pascal's Triangle, try to solve the original problem

Make up your own problems, using any word with an odd number of letters

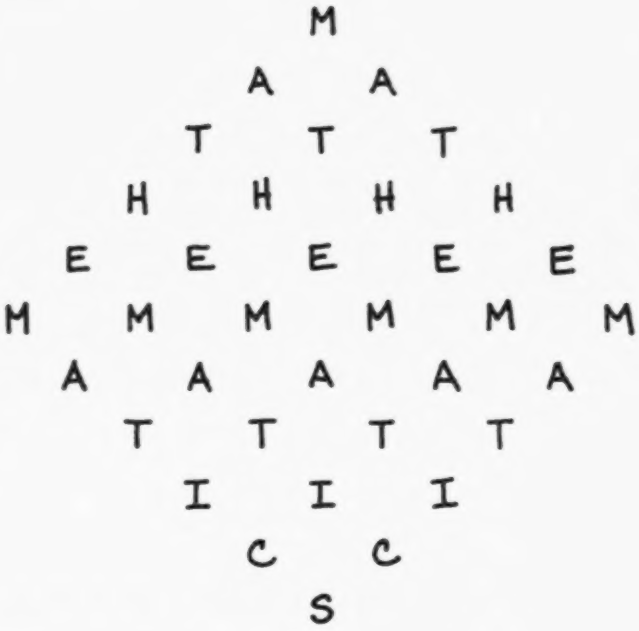
Let Pascals Triangle provide the solution!

Mathematics Series, Set C

1987 AIMS Education Foundation

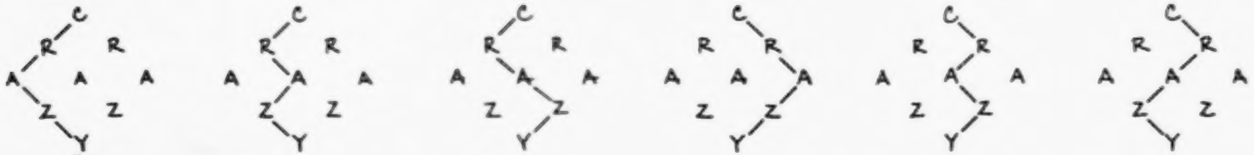
M·A·T·H·E·M·A·T·I·C·S

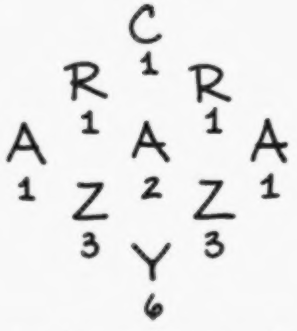
Examine the arrangement of letters to the right. Starting at the top, how many downward paths can you take to spell "MATHEMATICS"?



Try an easier problem. How many paths can you take to spell "CRAZY" assuming you start at the top and move down?

There are six possible paths. They are traced below.





If you place these letters on Top of Pascal's Triangle, with the "C" on the top "1," The triangle will reveal the solution to this problem!

Now, using Pascal's Triangle, try to solve the original problem.

Make up your own problems, using any word with an odd number of letters.

Let Pascal's Triangle provide the solution!

AIMS Newsletter Subscription Information

Each issue of the AIMS Newsletter contains a wealth of resources consisting of new AIMS integrated mathematics/science investigations, simple science experiments, and problem solving mathematics activities.

The AIMS Newsletter is published monthly, August through May. Subscriptions are on an annual basis only. A subscription entered at any time will receive the 10 issues for that year beginning with the previous August issue. This format is used since many of the articles in an annual volume are interrelated and all need to be available for maximum benefit.

The average issue of an AIMS Newsletter contains four or more new AIMS investigations, at least one each at the K-2, 3-5, and 6-9 grade levels; one 8.5 x 11 inch blackline master poster describing a simple science experiment; two 8.5 x 11 inch blackline master posters displaying problem solving situations; information about developments in the AIMS program, workshops, courses, and other activities; feature articles of lasting value dealing with science instruction problem solving in mathematics, etc.; a description of how a school, district, or state is implementing AIMS in a systemmatic manner; activities by members of the AIMS National Leadership Network and the writing teams; a thorough preview of all new AIMS and SETUP publications; information about conference presentations by the program directors of AIMS where participants can meet with them personally; and a periodic listing of all AIMS publications.

The problem solving poster series in the Newsletter is accompanied by a thorough analysis of problem-solving approaches appropriate to each situation. This analysis serves as an aid to classroom teachers who wish to enhance their own knowledge of problem solving and helping students acquire an inventory of problem-solving skills. Authored by Wilbert Reimer and Arthur Wiebe, both of whom studied extensively under Dr. George Polya at Stanford University, both series reflect his influence.

The ten issues in the annual volume contain forty or more new AIMS investigations, ten science posters, and twenty problem-solving challenges, plus numerous articles dealing with the teaching of "hands-on" science, evaluating higher order thinking skills and student progress in mastering process skills, and other enriching resources.

Since duplication rights for one school site are granted for all materials published in the Newsletter, it is highly cost effective for a school to enter a subscription and build a library for the use of all of its teachers.

The annual subcription price is $22.50. The entire first volume of ten issues (1986-7) is still available for $22.50. Schools purchasing the first volume and entering a subscription for the second year (1987-8) may do so at the reduced price of $40.00 for both. The number of sets of Volume 1 is limited, however, and early purchase is recommended.

AIMS Newsletter Subscription Form

The **AIMS Newsletter** is published monthly, August through May. Subscriptions are accepted on this annual basis only. Any subscription entered at any time of the year will receive all of the issues, August through May, of that year.

Each of the issues, beginning with March, 1987, includes the following:

- ★ four or more new AIMS investigations with at least one at each grade level: K-2, 3-5, and 6-9
- ★ one 8.5 x 11 inch blackline master science poster
- ★ two 8.5 x 11 inch blackline master mathematics posters from two different series
- ★ information about the broad range of AIMS activities
- ★ AIMS workshop information
- ★ activities of the AIMS National Leadership Network

The AIMS Newsletter also includes timely articles on such topics as problem solving; integration of mathematics/science/language arts, etc; how school districts are implementing AIMS in a systemmatic manner; new publications of the AIMS Education Foundation; information about conferences in which AIMS will be presented and where attendees will have the opportunity to meet AIMS personnel; etc.

First year subscriptions are still available at $20.00 per year. The new subscription price for 1987-8 is $22.50.

Check One:

____ Renewal subscription for 1987-8, $20.00
____ New Subscription for 1987-8, $22.50
____ Purchase of 1986-7 packet containing all ten issues, $22.50 (available May, 1987)
____ Purchase of 1986-7 packet containing all ten issues and New 1987-8 subscription, $40.00

Subscription Information:

Name: ____________________

Address: ____________________
Street

____
City State Zip Code

Make payment to: AIMS Education Foundation
Box 7766, Fresno, Ca 93747

Application to Host "Saturday with AIMS" Workshop

Name of School: ____________________

Mailing Address: ____________________
Street

____
City State Zip Code

Workshop Location Address: ____________________

Telephone: ____________________

Name of Applicant: ____________________

Principal if other than applicant: ____________________

Date Requested: First Choice: ____________________

Second Choice: ____________________

Projected number of participants from host district: __________

Are teachers from other districts welcome? __________

Mail the completed form to: **AIMS Education Foundation**
P.O. Box 7766
Fresno, California 93747

Individual "Saturday with AIMS" Request

I am interested in attending a "Saturday with AIMS" workshop in my area.
Please notify me of the scheduled workshop available.

Name: ____________________

Mailing Address: ____________________
Street

____
City State Zip Code

Telephone No. (   ) ____________________

Distance you would commute: __________

Mail to: (as above)

Second San Diego Area Workshop
Scheduled for July 27-31

The date for the second San Diego AIMS Workshop is July 27-31, not July 13-17 as announced in the April AIMS Newsletter.

The Poway Unified School District AIMS Workshop has developed a waiting list. This newly scheduled workshop should make it possible for all teachers in the San Diego area who wish to attend to be accommodated.

Remember to renew your subscription by June 15, 1987 to save $2.50! Subscription renewals received by June 15 are $20.00. After June 15 the subscription price is $22.50.

1987 PROJECT AIMS WORKSHOP PRE-REGISTRATION

All information requested below must be supplied before this pre-registration can be accepted and processed. A deposit of $50 or a school district purchase order must accompany this pre-registration.

Name ______________________ Social Security No.______________

Street ______________________ City ______________

State ______________ Zip__________ Home Phone (   )______________

School District ______________________________

School ______________ Grade Level________ School Phone (   )______________

Please enroll me in the workshop indicated. All are in California unless otherwise indicated.

- ☐ Davis, California June 15-19
- ☐ Fairfield-Suisun Unified School District, June 22-26
- ☐ Edmonds (Washington) School District, June 22-26
- ☐ San Jose Unified School District, June 22-26
- ☐ Northern Arizona University, Flagstaff, Arizona July 6-10
- ☐ Ventura Unified School District, July 13-17
- ☐ Placentia Unified School District, July 13-17
- ☐ San Diego Area, July 27-31
- ☐ Mother Lode Union School District, July 20-24
- ☐ Sacramento (TEC Center), July 27-31
- ☐ Berryessa Union School District (San Jose), August 3-7
- ☐ Poway Unified School District, August 10-14 — FULL
- ☐ Hesperia School District, August 10-14
- ☐ El Monte City School District, August 17-21
- ☐ Azusa Union School District, August 24-28
- ☐ Bremerton (Washington) date to be announced

Please return the registration form together with the $50 deposit or district purchase order to:
AIMS Workshops, AIMS Education Foundation, P.O. Box 7766, Fresno, California 93747

Note: The deposit is refundable only if the request is made at least 45 days before the workshop begins and there is a replacement from the waiting list. Based on past experience, it is anticipated that waiting lists will develop for all of the workshops.

AIMS Education Foundation
P.O. Box 7766
Fresno, California 93747

Non-Profit
U.S. POSTAGE
PAID
FRESNO, CA
PERMIT NO. 710

Please circulate to all teachers